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NAVSHIPS 91089

INSTRUCTION BOOK

for

FIELD INTENSITY METERS
TS-318/UP AND TS-635/UP

WASHINGTON INSTITUTE OF TECHNOLOGY, INC.
WASHINGTON, D.C.

BUREAU OF SHIPS NAVY DEPARTMENT

T. O. No. 16-35TS318-5

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BUREAU OF SHIPS NAVY DEPARTMENT

Contracts: NXsr-88850
NObsr-39362

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LIST OF EFFECTIVE PAGES

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ADDRESS NAVY DEPARTMENT,
BUREAU OF SHIPS

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NAVY DEPARTMENT
BUREAU OF SHIPS
WASHINGTON 25, D. C.

21 May 1948

Code 993-100

To: All Activities concerned with the Installation, Operation and Maintenance of the Subject Equipment.

Subj: Instruction Book for Field Intensity Meters TS-318/UP and TS-635/UP, NAVSHIPS 91089.

1. NAVSHIPS 91089 is the instruction book for the subject equipments and is in effect upon receipt, superseding the preliminary instruction book for each of the subject equipments. Upon receipt hereof, the preliminary instruction book shall be destroyed.

2. When superseded by a later edition, this publication shall be destroyed.

3. Extracts from this publication may be made to facilitate the preparation of other Navy Instruction Books and Handbooks.

4. All requests for NAVSHIPS Electronics publications should be directed to the nearest District Publications and Printing Office. When revised books are distributed, notice will be included in the applicable maintenance bulletin and the ELECTRON Magazine.

E. W. MILLS
Chief of Bureau

FROM BUREAU OF SHIPS, NAVY DEPARTMENT, WASHINGTON 25, D. C.

RECORD OF CORRECTIONS MADE

CHANGE NO.	DATE	SIGNATURE OF OFFICER MAKING CORRECTION

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GUARANTEE

The equipment, including all parts and spare parts, except vacuum tubes, batteries, rubber and material normally consumed in operation, is guaranteed for a period of one year from the date of delivery of the equipment to and acceptance by the Government with the understanding that all such items found to be defective as to material, workmanship or manufacture will be repaired or replaced, f.o.b. any point within the continental limits of the United States designated by the Government, without delay and at no expense to the Government; provided that such guarantee will not obligate the Contractor to make repair or replacement of any such defective items unless the defect appears within the aforementioned period and the Contractor is notified thereof in writing within a reasonable time and the defect is not the result of normal expected shelf life deterioration.

To the extent the equipment, including all parts and spare parts, as defined above, is of the Contractor's design or is of a design selected by the Contractor, it is also guaranteed, subject to the foregoing conditions, against defects in design with the understanding that if ten percent (10%) or more of any such said item, but not less than two of any such item, of the total quantity comprising such item furnished under the contract, are found to be defective as to design, such item will be conclusively presumed to be of defective design and subject to one hundred percent (100%) correction or replacement by a suitably redesigned item.

All such defective items will be subject to ultimate return to the Contractor. In view of the fact that normal activities of the Naval Service may result in the use of equipment in such remote portions of the world or under such conditions as to preclude the return of the defective items for repair or replacement without jeopardizing the integrity of Naval communications, the exigencies of the Service, therefore, may necessitate expeditious repair of such items in order to prevent extended interruption of communications. In such cases the return of the defective items for examination by the Contractor prior to repair or replacement will not be mandatory. The report of a responsible authority, including details of the conditions surrounding the failure, will be acceptable as a basis for affecting expeditious adjustment under the provisions of this contractual guarantee.

The above one-year period will not include any portion of time the equipment fails to perform satisfactorily due to any defects, and any items repaired or replaced by the Contractor will be guaranteed anew under this provision.

INSTALLATION RECORD

Contract Number NXsr-88850 Date of Contract 5 February 1945

Contract Number NObsr-39362 Date of Contract 26 June 1947

Serial Number of Equipment..

Date of Acceptance by the Navy..

Date of delivery to contract destination..

Date of completion of installation..

Date placed in service..

Blank spaces on this page shall be filled in at time of installation. Operating personnel shall also mark the "date placed in service" on the date of acceptance plate located below the model nameplate on the equipment, using suitable methods and care to avoid damaging the equipment.

REPORT OF FAILURE

Report of failure of any part of this equipment, during its entire service life, shall be made to the Bureau of Ships in accordance with current regulations using form NAVSHIPS NBS 383 (revised) except for Marine Corps equipment, in which case "Signal Equipment Failure Report" form shall be used and distributed in accordance with instructions pertaining thereto. The report shall cover all details of the failure and give the date of installation of the equipment. For procedure in reporting failures see Chapter 67 of the Bureau of Ships Manual or superseding instructions.

ORDERING PARTS

All requests or requisitions for replacement material shall include the following data:

1. Federal stock number or, when ordering from a Marine Corps or Signal Corps supply depot, the Signal Corps stock number.
2. Name and short description of part.

If the appropriate stock number is not available the following shall be specified:

1. Equipment model or type designation, circuit symbol, and item number.
2. Name of part and complete description.
3. Manufacturer's designation.
4. Contractor's drawing and part number.
5. JAN or Navy type number.

SAFETY NOTICE

The attention of officers and operating personnel is directed to Chapter 67 of the Bureau of Ships Manual or superseding instructions on the subject of radio-safety precautions to be observed.

This equipment employs voltages which are dangerous and may be fatal if contacted by operating personnel. Extreme caution should be exercised when working with the equipment.

While every practicable safety precaution has been incorporated in this equipment, the following rules must be strictly observed:

KEEP AWAY FROM LIVE CIRCUITS:

Operating personnel must at all time observe all safety regulations. Do not change tubes or make adjustments inside equipment with high voltage supply on. Under certain conditions dangerous potentials may exist in circuits with power controls in the off position due to charges retained by capacitors. To avoid casualties always remove power and discharge and ground circuits prior to touching them.

DON'T SERVICE OR ADJUST ALONE:

Under no circumstances should any person reach within or enter the enclosure for the purpose of servicing or adjusting the equipment without the immediate presence or assistance of another person capable of rendering aid.

DON'T TAMPER WITH INTERLOCKS:

Do not depend upon door switches or interlocks for protection but always shut down motor generators or other power equipment. Under no circumstances should any access gate, door, or safety interlock switch be removed, short-circuited, or tampered with in any way, by other than authorized maintenance personnel, nor should reliance be placed upon the interlock switches for removing voltages from the equipment.

RESUSCITATION

AN APPROVED POSTER ILLUSTRATING THE RULES FOR RESUSCITATION BY THE PRONE PRESSURE METHOD SHALL BE PROMINENTLY DISPLAYED IN EACH RADIO, RADAR, OR SONAR ENCLOSURE. POSTERS MAY BE OBTAINED UPON REQUEST TO THE BUREAU OF MEDICINE AND SURGERY.

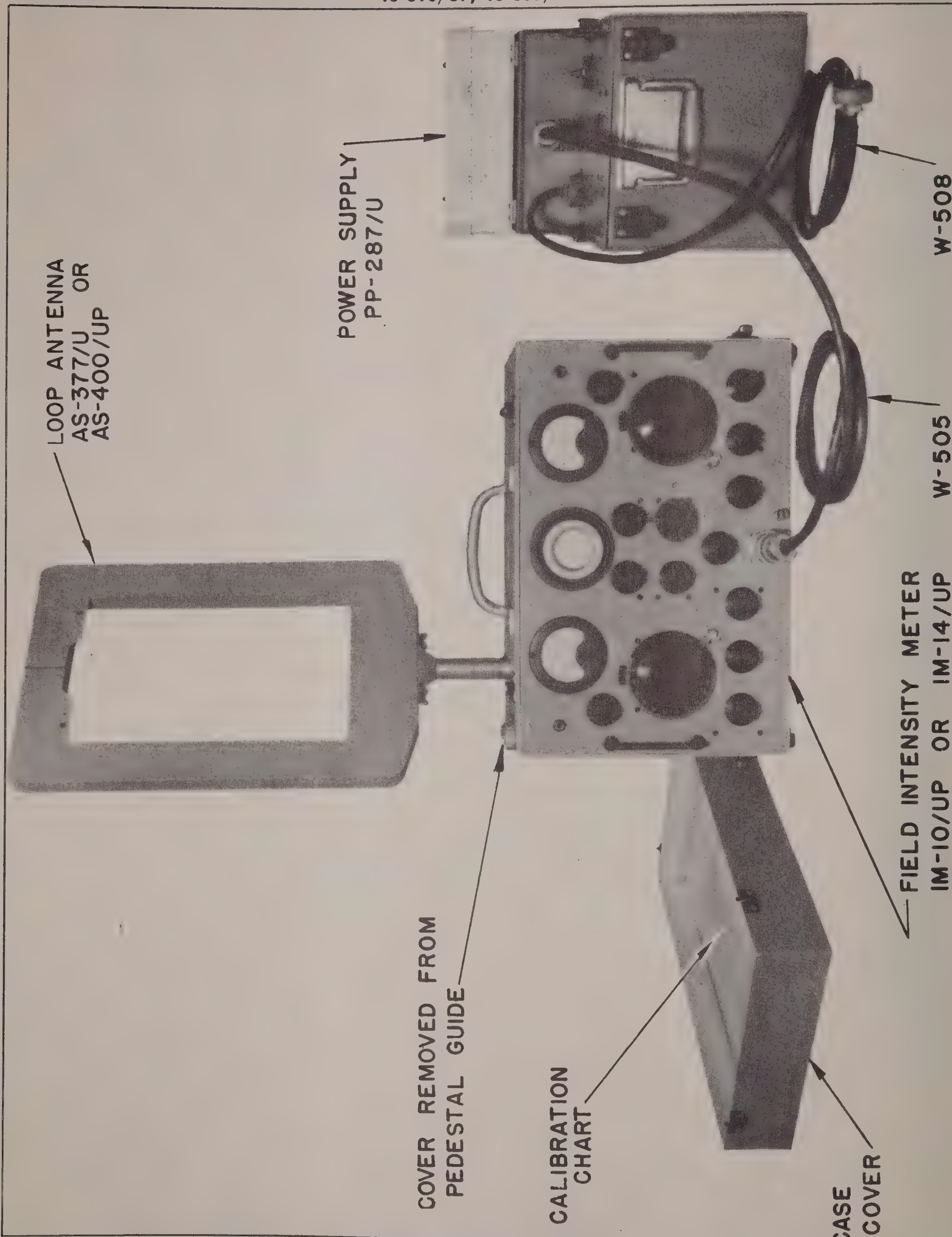

Figure 1-1. Field Intensity Meter, TS-318/UP or TS-635/UP

SECTION 1

GENERAL DESCRIPTION

1. INSTRUCTION BOOK COVERAGE.

This instruction book describes the adjustment, operation and maintenance of Field Intensity Meters TS-318/UP and TS-635/UP.

2. GENERAL.

(See figure 1-1.)

Each of these equipments is a complete portable instrument consisting of a field intensity meter, a power supply unit and accessories. Field Intensity Meter TS-318/UP is used for making field intensity measurements in the frequency range of 1550 kc. to 2500 kc. while Field Intensity Meter TS-635/UP is used for making field intensity measurements in the 110 kc. to 220 kc. frequency range.

These units are contained in grey wrinkle-finished aluminum carrying cases provided with carrying handles on each end. All accessories and cables are stowed in the carrying case covers. (See figure 1-2.)

3. PURPOSE AND BASIC PRINCIPLES

a. The basic principle of operation of both of these equipments consists of comparing the intensity and pulse recurrence rate (PRR) of Loran signals detected by the receiver against a measured pulse signal gen-

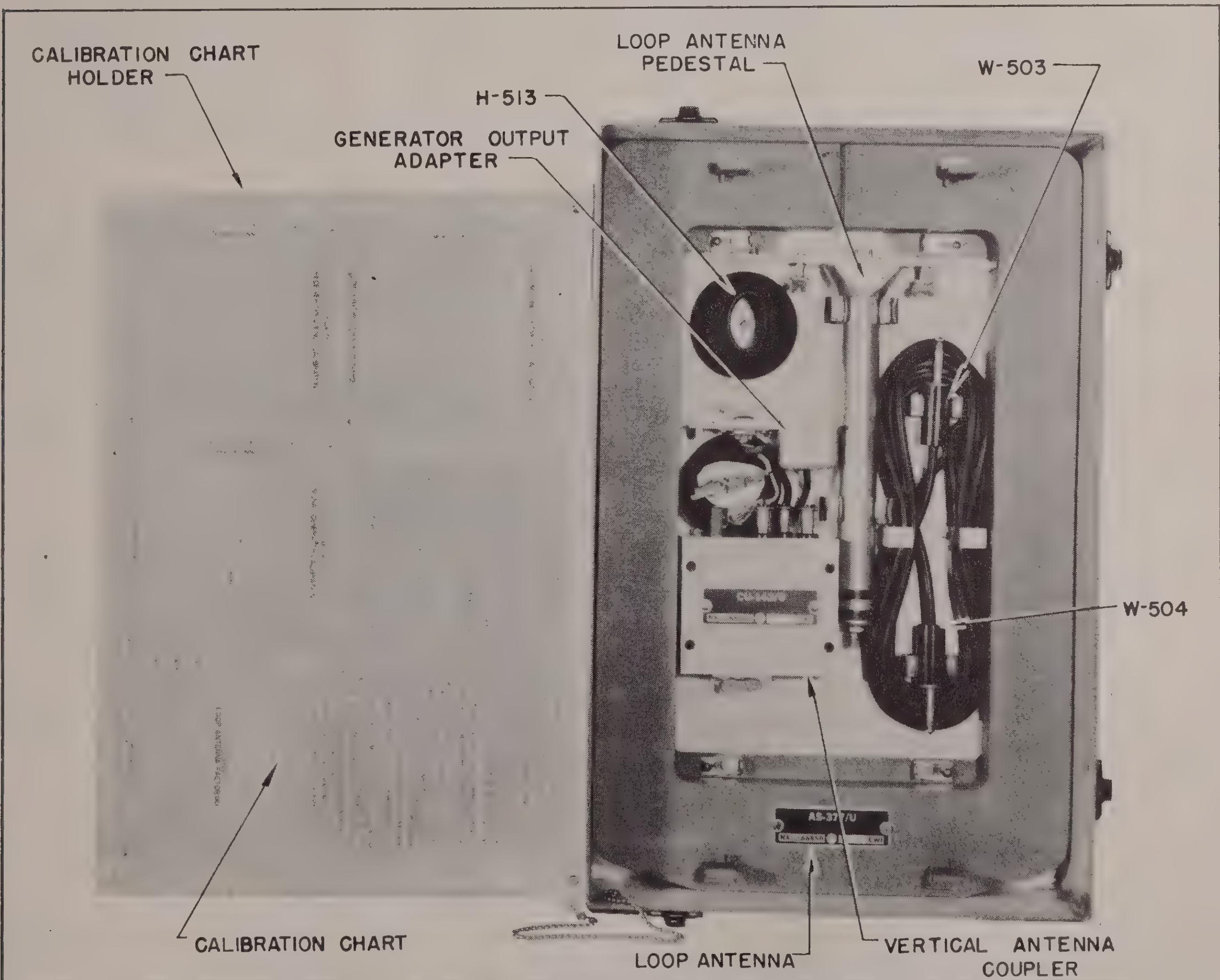

Figure 1–2. Cover, Field Intensity Meter IM–10/UP or IM–14/UP, Accessories Stowed

erated in the equipment. The comparison is made by superimposing both signals on the vertical deflecting plates of the cathode ray tube, adjusting the sweep rate so that the pulses remain stationary on the screen and adjusting the height of the calibrating pulse to the same height as the incoming signal. By use of the Field Intensity graphs, the intensity of this signal is obtained from the vacuum tube voltmeter reading. The PRR is obtained from the reading of the sweep frequency dials.

b. The field intensity of continuous wave (CW) signal may be determined also with these equipments by measuring the amount of internally generated CW voltage necessary to give the same deflection of the *CW* and *Test* Meter as the received signal.

4. DESCRIPTION OF MAJOR UNITS.

(See figure 1-1.)

a. FIELD INTENSITY METER TS-318/UP.

(1) FIELD INTENSITY METER IM-10/UP.

(a) This unit contains the Receiver, Signal Generator, Vacuum Tube Voltmeter, Sweep Generator, Cathode Ray Indicator Unit and the CW and Test Meter used for making field intensity measurements in the frequency range of 1550 kc. to 2500 kc. All of these subassemblies are fastened to an aluminum front panel which is mounted in an aluminum case by ten fasteners so that the panel is in the vertical plane in the operating position. All of the controls and connectors necessary for operation are mounted on the front panel except the power switch on Power Supply PP-287/U.

(b) A removable cover, fastened to the main unit by four drawbolts, encloses the front panel, providing protection when the instrument is not in use. A receptacle is provided on the top of the instrument case as a bearing for the Antenna Assembly AS-377/U or AS-400/UP when they are in use. This receptacle is covered by a screw cap which is chained to the top surface. The front panel cover also houses the Antenna Assembly, Antenna Coupler, Video and External Sync. Cables, Calibration Charts and Instruction Books when they are not in use or when the instrument is being transported.

(2) ANTENNA ASSEMBLY AS-377/U.

(a) This assembly, designed for receiving signals in the 1550 kc. to 2500 kc. range, consists of the Loop Antenna and Pedestal which are fastened together by a plug and fasteners when in use or separated for being carried in the cover.

(3) ANTENNA COUPLER CU-142/U.

(a) This unit, designed to match a vertical antenna to the TS-318/UP equipment in the 1550 kc. to 2500 kc. frequency range, is contained in a small aluminum case designed to be plugged into and securely fastened to the Antenna Assembly Pedestal in place of the Loop Antenna. Three binding posts are provided for connection to vertical antennas, not supplied with the equipment, having different characteristics.

b. FIELD INTENSITY METER TS-635/UP.

(1) FIELD INTENSITY METER IM-14/UP.—The description of this unit is the same as that of Field Intensity Meter IM-10/UP except that it is for use in the frequency range of 110 kc. to 220 kc. and a control has been added on the lower right hand side of the case.

(2) ANTENNA ASSEMBLY AS-400/UP.—This unit has the same appearance as Antenna Assembly AS-377/U except that it is designed for 110 kc. to 220 kc. operation.

(3) ANTENNA COUPLER CU-155/U. — This unit has the same external appearance as Antenna Coupler CU-142/U except that it is designed for 110 kc. to 220 kc. operation.

c. POWER SUPPLY PP-287/U.

(1) This unit is mounted in an aluminum carrying case divided into two sections by a gasketed partition. One section is designed to house a Navy type 6V-SBM-50AH storage battery and the other section contains the electronic section of the unit. This section is mounted in the case with four screwdriver operated fasteners on the front panel which is in the horizontal plane in the operating position. Fuses, power switch, external battery connection posts, and 115 a. c. line receptacle are mounted on the front panel.

A cover for the carrying case is provided and fastens to the case by six drawbolts. The cover is hinged directly over the separating partition in the case so that access to the front panel is obtained without uncovering the battery compartment; however, the complete cover can be removed for servicing of the battery when necessary. The interunit power cable, 115 VAC power cable, and external battery cables are stowed in that section of the cover which encloses the power supply unit.

5. REFERENCE DATA.

a. NOMENCLATURE.

(1) FIELD INTENSITY METER, TS-318/UP.

(2) FIELD INTENSITY METER, TS-635/UP.

b. CONTRACT NUMBERS AND DATES.

(1) TS-318/UP—NXsr-88850 dated 5 February 1945.

(2) TS-635/UP—NXsr-88850 dated 5 February 1945.

(3) TS-318/UP—NObsr-39362 dated 26 June 1947.

c. CONTRACTOR. — Washington Institute of Technology, Inc., McLachlen Bldg., Washington, D. C.

d. COGNIZANT NAVAL INSPECTOR.—Inspector of Naval Material, 401 Water St., Baltimore, Maryland.

e. NUMBER OF BOXES INVOLVED PER COMPLETE SHIPMENT OF EQUIPMENT, EQUIPMENT SPARES INCLUDED.—Four boxes.

f. TOTAL CUBICAL CONTENTS, EQUIPMENT SPARES INCLUDED.

Crated—13.4 cubic feet

Uncrated—5.5 cubic feet

g. TOTAL WEIGHT, EQUIPMENT SPARES INCLUDED.

Crated—315 lbs.

Uncrated—172 lbs.

h. FREQUENCY RANGE.

(1) TS-318/UP, 1550 kc. to 2500 kc. in one band.

(2) TS-635/UP, 110 kc. to 220 kc. in one band.

i. TYPE OF FREQUENCY CONTROL—Manual tuning.

j. TYPE OF SIGNALS MEASURED.—Loran and Continuous Wave in the frequency ranges specified.

k. PULSE RECURRENCE RATES MEASURED.

S (slow)—49,300 to 50,000 microseconds

L (low)—39,300 to 40,000 microseconds

H (high)—29,300 to 30,000 microseconds

l. FIELD INTENSITY RANGE.

(1) WITH LOOP ANTENNA (supplied).—50 microvolts per meter to 15 volts per meter.

(2) WITH 60-FOOT VERTICAL ANTENNA (not supplied).—1 microvolt per meter minimum.

m. TYPE OF RECEIVER.—Superheterodyne.

n. INTERMEDIATE FREQUENCY.—455 kc.

o. OUTPUT INDICATORS.

(1) LORAN OR PULSE.—2-inch cathode ray tube.

(2) CW.—O-1 MA d. c. meter.

p. POWER SUPPLY CHARACTERISTICS.

(1) Power Supply Unit, Navy Type PP-287/U.

(2) 115 VAC, single phase, 60 cycle, or 6 VDC (internal or external battery).

(3) CURRENT.

(a) 115 VAC—.53 amperes at .9 power factor.

(b) 6 VDC—7.0 amperes.

q. EQUIPMENT LISTS.

(1) EQUIPMENT SUPPLIED.

TABLE 1–1. EQUIPMENT SUPPLIED

QUANTITY PER EQUIPMENT		NAME OF UNIT	NAVY TYPE DESIGNATION	OVERALL DIMENSIONS			VOLUME CU. FT.	WEIGHT LBS.
TS-318/UP	TS-635/UP			HEIGHT	WIDTH	DEPTH		
1	0	Field Intensity Meter	IM–10/UP	14 27/32	19 15/16	11 1/8	1.9	50.9
1	0	Antenna Assembly	AS–377/U	28 1/4	12	1 3/16	.22	5.5
1	0	Antenna Coupler	CU–142/U	4 3/4	3 15/16	1 11/16	31.5 cu. in.	.7
1	1	Power Supply (less battery)	PP–287/U	11 7/8	20 9/16	11 1/16	1.6	37.0
0	1	Field Intensity Meter	IM–14/UP	14 27/32	19 15/16	11 1/8	1.9	50.9
0	1	Antenna Assembly	AS–400/UP	28 1/4	12	1 3/16	.22	5.5
0	1	Antenna Coupler	CU–155/U	4 3/4	3 15/16	1 11/16	31.5 cu. in.	.7
1	1	Battery, Storage	6V–SBM–50AH	9 1/2	10	7 1/4	.4	40.0
1	1	Adapter, Signal Generator Output	CWI–62408					
1	1	Assembly, Interunit Power Cable	CWI–62407 (6′6″)					
1	1	Assembly, Power Cable						
1	1	Assembly, Video Output Cable						
1	1	Assembly, External Sync. Cable						
1	1	Eye Shield						
1	1	Assembly, Ext. Battery Cable (+)						
1	1	Assembly, Ext. Battery Cable (−)						
1 set	1 set	Charts, Calibration						
2	2	Books, Instruction						
1	1	Spare Parts, Equipment		12	18 1/16	12	1.5	45

(2) EQUIPMENT REQUIRED BUT NOT SUPPLIED.

(*a*) 1 Antenna, Vertical, 10 to 60 ft. high.

(3) SHIPPING DATA.

TABLE 1–2. SHIPPING DATA

SHIPPING BOX NO.		CONTENTS		OVERALL DIMENSIONS			VOLUME CU. FT.	WEIGHT LBS.
TS-318/UP	TS-635/UP	NAME	DESIGNATION	HEIGHT	WIDTH	DEPTH		
1		Field Intensity Meter	IM-10/UP	18¼	26⅝	18¼	5.2	104
1		Antenna Assembly	AS-377/U					
1		Antenna Coupler	CU-142/U					
1		Adapter, Signal Generator Output	CWI-62408					
1		Assembly, Video Output Cable						
1		Assembly, Ext. Sync. Cable						
1		Eye Shield						
1		Charts, Calibration						
2		Books, Instruction						
	1	Field Intensity Meter	IM-14/UP	18¼	26⅝	18¼	5.2	104
	1	Antenna Assembly	AS-400/UP					
	1	Antenna Coupler	CU-155/U					
	1	Adapter, Signal Generator Output	CWI-62408					
	1	Assembly, Video Output Cable						
	1	Assembly, Ext. Sync. Cable						
	1	Eye Shield						
	1	Charts, Calibration						
	2	Books, Instruction						
2	2	Powr Supply (less battery)	PP-287/U	16⅛	27¼	16⅛	4.2	90
2	2	Assembly, Interunit Power Cable	CWI-62407(6′6″)					
2	2	Assembly, Power Cable						
2	2	Assembly, External Battery Cable (+)						
2	2	Assembly, External Battery Cable (−)						
3	3	Battery, Storage	6V-SBM-50AH	13	14½	9½	1.1	60
*	*	Spare Parts, Equipment		14¾	24¼	14	2.9	80

* Numbered in consecutive order beginning with 1.

(4) ELECTRON TUBE COMPLEMENT.—Tube requirements for TS-318/UP and TS-635/UP are the same. (See Table 1-3.)

TABLE 1–3. ELECTRON TUBE COMPLEMENT

UNIT	NUMBER OF TUBES OF TYPE INDICATED												TOTAL NO. OF TUBES
	2AP1-A	6X5GT/G	6AK5	6AL5	6AS6	6AQ6	6SA7	OA3/VR-75	OD3/VR-150	8016	9002	9003	
Field Intensity Meter, IM–10/UP or IM–14/UP	1		2	1	3	1	1	1			2	3	15
Power Supply PP–287/U		1							1	1			3
Total number of each type	1	1	2	1	3	1	1	1	1	1	2	3	18

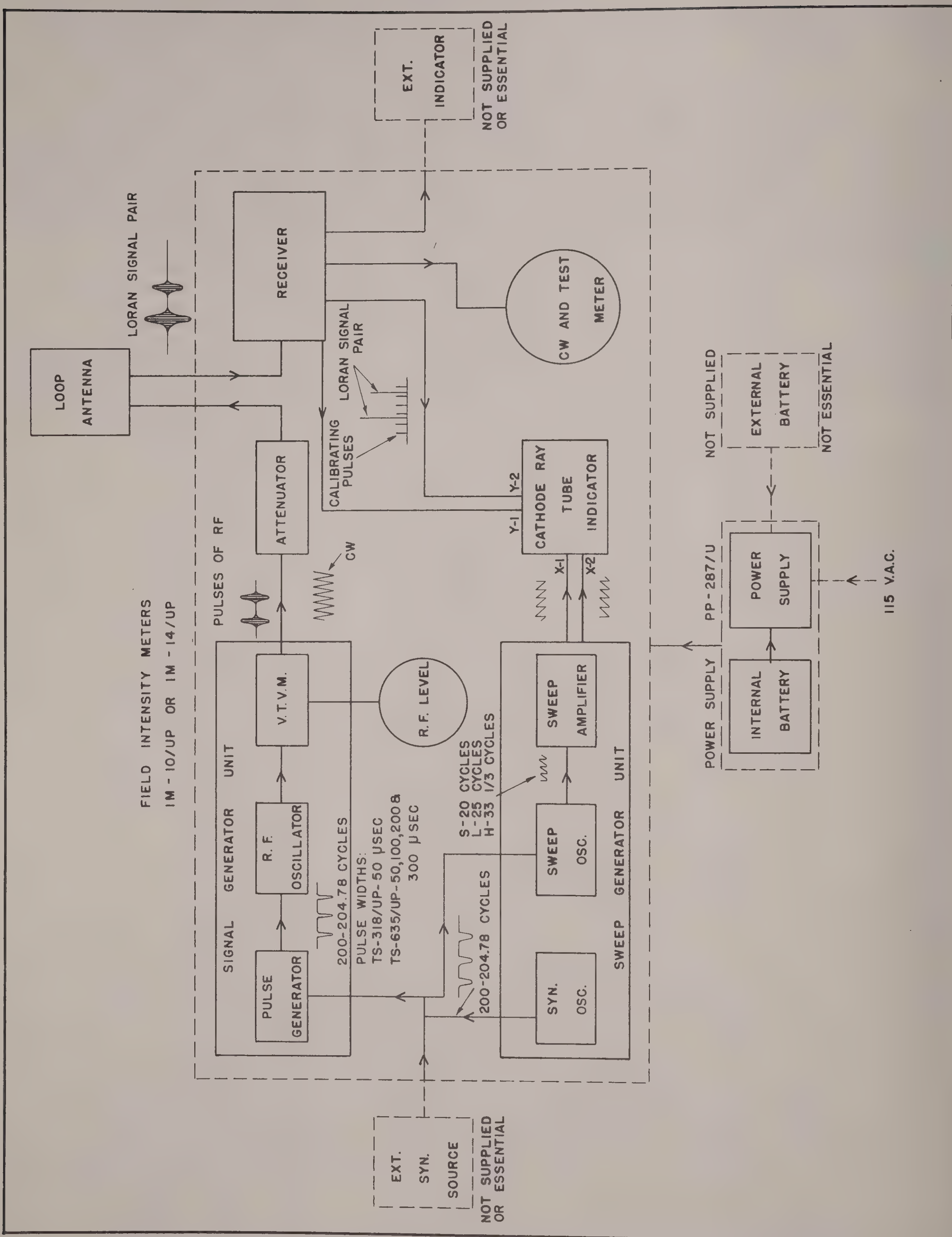

Figure 2-1. ***Block Diagram, Field Intensity Meter TS-318/UP or TS-635/UP***

SECTION 2
THEORY OF OPERATION

1. GENERAL CIRCUIT DESCRIPTION.

(See figure 2-1.)

a. Field Intensity Meter Equipments TS-318/UP and TS-635/UP are designed to measure the field intensity of the master and slave station pairs associated with Loran transmissions and of continuous wave radio frequency signals. TS-318/UP operates in the frequency range of 1,550 kc. to 2,500 kc. per second and TS-635/UP in the 110 kc. to 220 kc. per second frequency range. These equipments may be used also to identify Loran master and slave transmitting stations by determining their operating radio frequency and their pulse recurrence rates.

b. To fully accomplish this purpose, the Field Intensity Meter IM-10/UP or IM-14/UP consists of four basic units: a Cathode Ray Indicator Unit, a Sweep Generator Unit, a Signal Generator Unit, and a Receiver.

c. To determine the field intensity of a Loran signal, a pulse modulated signal from the self-contained Signal Generator Unit is applied in series with the Loop Antenna to the Receiver, simultaneously, with the Loran signal impressed on the antenna. Both of these signals, after being demodulated by the Receiver, appear as vertical pulses on the Cathode Ray Indicator screen. After the PRR controls are adjusted so that the Loran signals are stationary on the screen, the pulse recurrence rate of the signal is determined from the dial settings and the Specific PRR table supplied with the calibration chart. The RF frequency is determined from the Receiver dial reading and its calibration chart.

d. The function and operation of the pulse recurrence rate controls are directly dependent upon the sweep generator voltage. The voltage for the horizontal deflecting plates of the tube in the Cathode Ray Indicator Unit is supplied by the Sweep Generator Unit. The frequency of this generator is arranged in three basic steps corresponding to the standard Loran pulse recurrent rates. At the basic pulse recurrence rates of 30,000, 40,000 and 50,000 microseconds, the calibrating pulses are 5,000 microseconds apart so that six pulses appear on the Cathode Ray Indicator Unit screen when the sweep frequency is set on the "H" range, eight pulses on the "L" range, and ten pulses on the "S" range.

e. Voltage from the sweep generator is used also to synchronize the calibrating pulses from the signal generator. Synchronization of the sweep generator and the signal generator may, for test and calibrating purposes, be accomplished also from an external source, such as the 2,500 microsecond (nominal) pulses from the Models DAS and DAS-2 Radio Navigation Equipments, when this source is connected to the Field Intensity Meter by means of the cable assembly, W-503, and the *Ext. Sync.* jack, J-503, on the front panel. (See figure 7-27.)

f. An external indicator, such as the indicator of the Models DAS and DAS-2 Radio Navigation Equipments, may be used with the Field Intensity Meter for test purposes by connecting the video amplifier in the navigation equipment to the Video Output jack, J-502, on the Field Intensity Meter by means of cable assembly W-504. (See figure 7-27.)

WARNING

Jacks J-502 and J-503 are intended to be used for test and calibration purposes only. Connecting to these jacks during actual field intensity measurements may introduce undesirable signals directly into the field intensity meter and result in erroneous readings.

2. CIRCUIT ANALYSIS.

a. SWEEP GENERATOR UNIT. (See figure 7-28.)

This unit is identical in Field Intensity Meters IM-10/UP and IM-14/UP and consists of a synchronizing oscillator, a sweep oscillator, and a single stage push-pull amplifier. The synchronizing oscillator operates over a variable frequency range of 200 to 204.78 cycles per second and furnishes the timing impulses to control the sweep oscillator and the pulse oscillator in the Signal Generator Unit. The sweep oscillator operates on three frequencies of 20, 25, and 33⅓ cycles per second. The output of this oscillator is amplified by a push-pull stage to supply voltage for deflecting the cathode ray tube beam in the horizontal plane.

(1) SYNCHRONIZING OSCILLATOR. — This oscillator consists of an electron tube, type 6AS6, V-101, and associated components connected in a modified "Transitron" circuit. The suppressor and screen grids are coupled together by the paralleled capacitors C-103 and C-116, in series with resistor R-110. R-110 is chosen so as to make the suppressor grid negative with respect to the cathode. Electrons that have passed through the screen grid are repelled by the suppressor grid and return to the screen because of its high positive voltage. Hence, the suppressor grid with its retarding field acts as a virtual cathode.

A small negative change in voltage across the tuned circuit, consisting of resistors R-107, R-108, R-109 and capacitors C-115, C-117 and C-104, is transmitted to both the screen and suppressor grids causing the suppressor to repel more electrons which increases the

screen current. In this case, the transconductance between the screen and suppressor grids is negative, producing a negative resistance that is shunted across the tuned circuit, which makes the absolute magnitude of this resistance less than the parallel resonant impedance of the circuit, thus providing a condition of sustained oscillations.

Capacitors C-116 and C-115 are adjusted so that the oscillator frequency range of 200 to 204.78 cycles per second will be in the range of the *Specific PRR* resistor, R-107, when the *PRR Cal* resistor, R-108, is set approximately in the center of its range.

Automatic control of the oscillator output signal level is accomplished by rectifying the output from the plate of V-101, through capacitor C-101, by the crystal CR-101, which in turn changes the bias on the control grid of V-101 through resistor R-101. The varying negative voltage from CR-101 is impressed across the voltage divider consisting of resistors R-103 and R-104 and a portion of it is used to synchronize the sweep oscillator, V-102, the pulse generator, V-401, in the Signal Generator Unit, when the contacts on the *Ext. Sync.* jack, J-503, are closed.

(2) SWEEP OSCILLATOR.—This oscillator generates a "sawtooth" waveform at 20, 25, or 33⅓ cycles per second when the *Basic PRR* switch is set to "S", "L", or "H" range, respectively. It consists of a 6AS6 electron tube, V-102, with the screen and suppressor grids capacitively coupled together so that the suppressor voltage varies with changes in the screen voltage. The circuit constants are adjusted so that the tube will conduct for a short interval of time at the S, L, or H PRR rates. The frequency is determined by capacitors C-110, C-111, or C-112 switched into the circuit by S-101.

During the non-conducting interval, capacitors C-105, C-106, and C-107 in parallel are charged through plate resistors R-116 and R-117. These capacitors are large enough to provide a linear rise in the plate voltage when S-101 is in the "H" position. On the "L" and "S" positions, capacitors C-108 and C-109 are added to C-105, C-106, and C-107 to maintain the linearity at these lower frequencies. When V-102 conducts, these capacitors discharge through the tube and the plate voltage drops rapidly. The resultant voltage across the grid resistor of V-103 has a "sawtooth" waveform.

The sweep frequency is synchronized over the range of specific pulse recurrence rates by the variable voltage applied to the control grid. Since the calibrating pulse generator is synchronized by the same voltage, 10, 8, and 6 calibrating pulses appear on the cathode ray tube screen when S-101 is set to S, L, or H, respectively, and the *Specific PRR* is set to any point in its calibrated range.

(3) SWEEP AMPLIFIER.—A pair of 9002 electron tubes, V-103 and V-104, are utilized as a push-pull amplifier to provide a higher and more linear sweep voltage, for the DC potential available, than would be obtained if a single tube were used as an amplifier. Phase inversion between the control grids occurs because the grid of V-103 is coupled to the sawtooth signal source by capacitor C-114 while the grid of V-104 is driven by the voltage developed across the common cathode resistor R-122. The amplified output appears at terminals X1 and X2 on terminal board E-101.

b. CATHODE RAY INDICATOR UNIT. *(See figure 7-29.)*—The output of the Sweep Generator Unit on terminal board E-101 connects to the horizontal deflecting plates of the 2″ cathode ray tube, V-201, through terminals X1 and X2 on terminal board E-201. The Cathode Ray Tube Indicator Assembly consists of a sub-chassis mounted directly above the Sweep Generator chassis. This unit is identical in Field Intensity Meters IM-10/UP and IM-14/UP.

Direct current voltage from the power plug, J-501, pin D, connects directly to the "1,000 V." terminal on E-201, filament voltage 6.3 v. a. c. or d. c. from pins B and F on J-501 to A and G on E-201, and output of the video amplifier in the Receiver connects directly to the vertical deflecting plate terminals Y-1 and Y-2.

From the "1,000 V." terminal on E-201, the d. c. voltage is applied through a decoupling resistor, R-201, bypassed by capacitor C-201 to the anode No. 2 (grid No. 2) of the cathode ray tube 2AP1A, V-201, through resistor R-212. This voltage at the junction of resistors R-201 and R-212 and capacitor C-201 is applied also to the horizontal centering network R-202, R-205 and R-206 and vertical centering net work R-203, R-209 and R-210, which are in parallel and then in series with the focusing control, variable resistor R-213, resistor R-214, resistor R-215 and intensity control, variable resistor R-216.

Each end of the horizontal centering control is connected to one of the horizontal deflecting electrodes in V-201 through 4.7 megohm resistors R-204 and R-207. When the horizontal centering control is adjusted properly, the electron beam will be centered horizontally on the screen. The beam is deflected horizontally by the "sawtooth" sweep voltage from the Sweep Generator Unit applied to the horizontal electrodes of V-201 through coupling capacitors C-202 and C-203. The horizontal deflection plates are maintained at the same RF potential by capacitor C-206 in order to prevent high frequency signals from affecting the sweep.

In like manner, the electron beam is adjusted vertically by the vertical centering potentiometer, R-203, voltage being applied to the vertical deflecting electrodes through voltage dropping resistors R-208 and R-211. The beam is deflected vertically by the signal and calibrating pulses from the video amplifier in the Receiver through coupling capacitors C-204 and C-205 connected from Y-1 and Y-2 on terminal board E-201 to the electrodes.

c. SIGNAL GENERATOR UNIT. *(See figures 7-32 and 7-33.)*—The Signal Generator chassis contains the

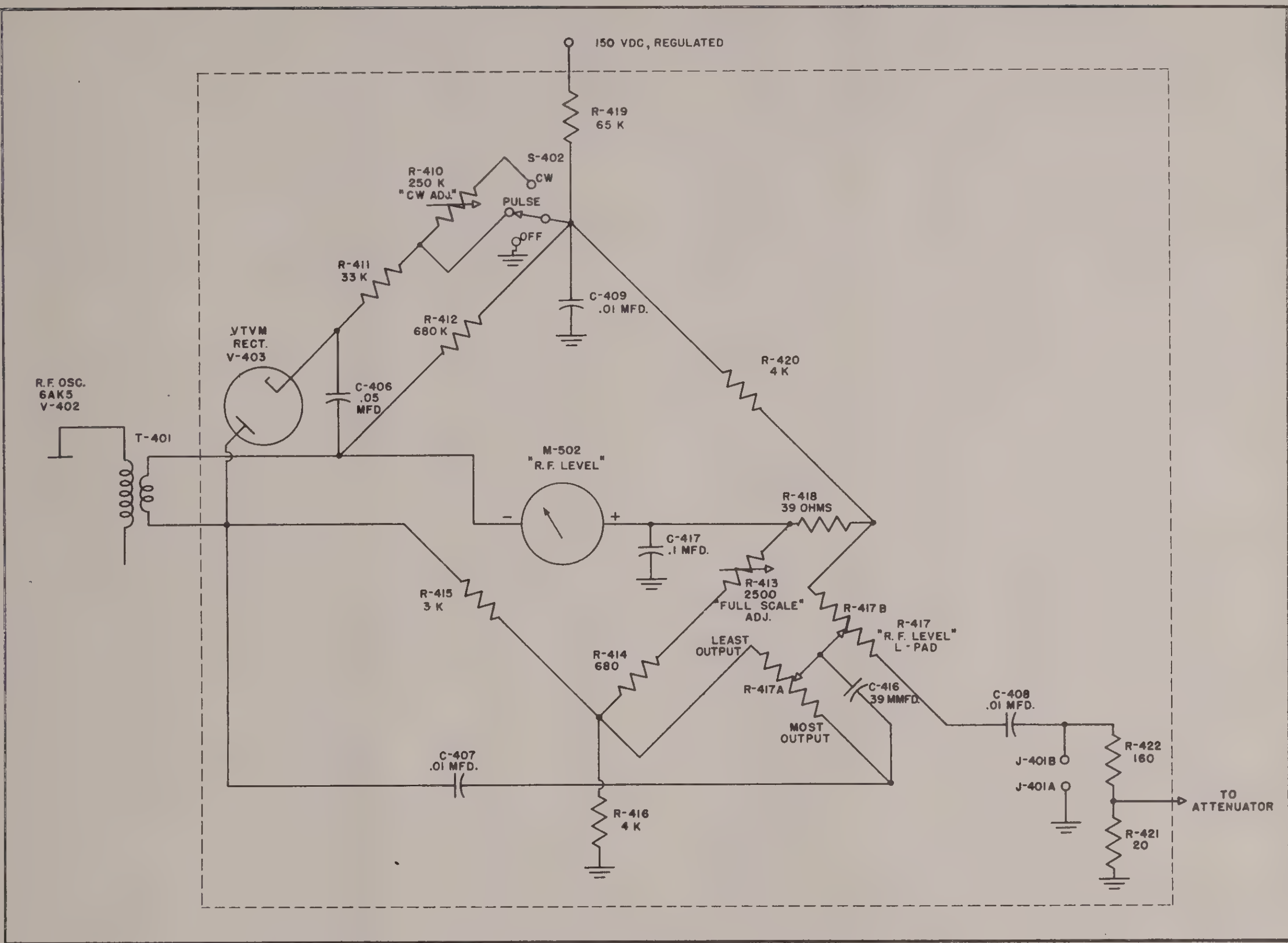

Figure 2–2. Simplified Schematic, Vacuum Tube Voltmeter Circuit

calibrating pulse generator, R.F. oscillator, vacuum tube voltmeter, and an attenuator network. This unit is not identical in Field Intensity Meters IM-10/UP and IM-14/UP. Differences occur in the Pulse Generator, R.F. oscillator, and vacuum tube voltmeter as described in Sec. 2-2*c*(2), 2-2*c*(4) and 2-2*c*(5).

(1) CALIBRATING PULSE GENERATOR, FIELD INTENSITY METER IM-10/UP.—Calibrating pulses, 50 microseconds wide, are generated in a 6AS6 electron tube, V-401, connected in a transitron circuit similar to the sweep oscillator tube V-102; however, in this case, the pulse is applied to the R.F. oscillator V-402, through the coupling capacitor C-402 and section S-401A of the *OFF-PULSE-CW* switch S-401. Synchronizing voltage is applied to the control grid from the 200-cycle oscillator, V-101, in the Sweep Generator chassis, through the R.F. filter composed of capacitors C-411 and C-410 and resistor R-433.

(2) CALIBRATING PULSE GENERATOR, FIELD INTENSITY METER IM-14/UP.—Pulse widths of 50, 100, 200 and 300 microseconds are obtained by switching the suppressor-screen grid coupling capacitors C-401, C-418, C-419, and C-420 and resistors R-402, R-438, R-439, R-440 into the generator circuit with switch sections S-403A and S-403B.

(3) R.F. OSCILLATOR, FIELD INTENSITY METER IM-10/UP.—The R.F. oscillator is composed of a 6AK5 tube, V-402, in a modified tuned plate oscillator circuit and tuned over the frequency range of 1,550 kc. to 2,500 kc. by capacitor C-405 that is connected across part of the adjustable iron core transformer, T-401. Normally, V-402 is completely cut off by the bias voltage developed across cathode resistor R-405; however, with switch S-401B in the *Pulse* position, pulses from the pulse generator V-401 overcome the cathode bias allowing V-402 to oscillate for the duration of the pulse, approximately 50 microseconds. Capacitor C-403, which is charged to the full value of plate voltage when V-402 is cut off, is large enough to maintain the plate voltage at a maximum for the pulse duration.

With switch S-401A in the *CW* position, the cathode of V-402 is grounded and the oscillator operates continuously. In this condition grid bias is effected by grid resistor R-406. Capacitor C-403 provides an R.F. return to the cathode. To compensate for the

difference in output of the R.F. oscillator on *Pulse* and *CW* operation, different plate voltage dropping resistors R-408 and R-409 are switched into the circuit by section S-401B of the *OFF-PULSE-CW* switch.

The output of the R.F. oscillator is inductively coupled to the Vacuum Tube Voltmeter circuit by the secondary of transformer T-401 and passes through capacitor C-407, the variable "L" pad, R-417A and R-417B, *RF Level,* and decade ladder resistance attenuator, *Multiply By,* to the Loop Antenna Pedestal connector, J-301.

(4) R. F. OSCILLATOR, FIELD INTENSITY METER IM-14/UP.—This generator is the same as described in Sec. 2-2*c*(3) except that capacitor C-405 and transformer T-401 are adjusted to resonate in the frequency range of 110 kc. to 220 kc. per second and capacitor C-404, resistors R-436 and R-406 are changed in value because of the lower operating frequency.

(5) VACUUM TUBE VOLTMETER. *(See figure 2-2.)*—With no RF voltage applied to the secondary of T-401 and the "L" pad R-417A and R-417B set to minimum, the *RF Level* meter M-502 reads less than zero because of the d. c. voltage drop across resistor R-420. Low tolerance wire wound resistors R-419, R-420, and R-416 are used to maintain this delay voltage at 8.2 VDC in Field Intensity Meter IM-10/UP or 8.8 VDC in Field Intensity Meter IM-14/UP. It is necessary to apply a peak RF voltage equal to the delay voltage to the bridge circuit from T-401 before the meter will read zero. Zero setting of the meter is accomplished by varying resistor R-503, *Zero Adj.* control, which in turn changes the plate voltage on the RF oscillator V-402 (See figure 2-3). As the "L" pad is advanced, the bridge becomes more unbalanced and the meter reading becomes greater. Thus the meter may be calibrated in terms of RF Level from the minimum to the maximum positions of the "L" pad. The decimal factor, *Multiply By,* determined by the setting of the decade attenuator, must be applied to the *RF Level* meter reading to determine the signal level at the output of the attenuator.

High voltage from J-501, power receptacle on the front panel, is connected to the *250 V.* terminal on board E-402. A regulated voltage of 225 V. at the *O Adj.* terminal on E-402 is provided from this voltage by regulator tubes V-404 on the Signal Generator Unit and V-603 in the Power Supply Unit in series with current limiting resistors R-434 and R-435 and internal connection between pins 3 and 7 on V-404. (See figure 2-3.) The voltage applied to the *150 V.* terminal on E-401, supplying plate voltage for the pulse generator V-401 and the vacuum tube voltmeter circuit, is regulated by V-603 in the Power Supply Unit.

d. ANTENNA ASSEMBLY AS-377/U.—The Antenna Assembly, used with Field Intensity Meter IM-10/UP, consists of a six-turn loop enclosed in an electrostatic shield. Each end of the loop and the shield is connected to a removable pedestal which in turn plugs into the antenna receptacle, J-301, on the Receiver. The loop connections are carried through the pedestal, shielded from each other, and are connected one to the tip contact and the other to a ring contact insulated from the tip and the barrel of the pedestal.

e. ANTENNA ASSEMBLY AS-400/UP.—This antenna assembly, used with Field Intensity Meter IM-14/UP, is physically identical to Antenna Assembly AS-377/U, except that the loop consists of 12 turns of wire.

f. ANTENNA COUPLER CU-142/U. *(See figure 7-34.)*—This unit is designed to match the impedance of a vertical antenna from 10 to 60 ft. in length to Field Intensity Meter IM-10/UP, for operation in the frequency range of 1,550 kc. to 2,500 kc. Sections of the tapped, iron core tuned inductor, L-501, are selected by connecting the antenna to one of the binding posts, A-1, A-2 or A-3. The selected section of L-501 and the input winding of T-501, fixed-tuned by capacitor C-501, are in series with the antenna and the attenuator. The second winding of T-501, adjusted by an iron core, is connected between the receiver input and ground through the antenna receptacle, J-301, and is tuned by capacitors C-302 and C-303A.

g. ANTENNA COUPLER CU-155/U. *(See figure 7-35.)*—This unit is designed to match the impedance of a vertical antenna, 10 to 60 ft. in length, to Field Intensity Meter IM-14/UP for operation in the frequency range of 110 kc. to 220 kc. The section of the tapped, iron core tuned inductor, L-501, which is selected for use by connecting the antenna to one of the three binding posts, A-1, A-2, or A-3 is in series with the antenna and input coil of transformer T-501 to ground. The second winding of T-501 is connected in series with the primary winding of the antenna transformer, Z-307, and the attenuator through the antenna receptacle, J-301.

h. RECEIVER. *(See figures 7-30 and 7-31.)*—The receiver employs a superheterodyne circuit consisting of one tuned radio frequency stage using a pentode 6AK5, V-301, a pentagrid converter 6SA7, V-302, connected as a mixer and oscillator, three tuned intermediate frequency stages using miniature pentodes, type 9003, for V-303, V-304, V-305, and a duo-diode triode 6AQ6, V-306, used as a diode second detector and diode biased video amplifier.

Antenna receptacle J-301 contains three contacts which connects both ends of the loop into the circuit and connects the loop antenna shield to ground. In the Field Intensity Meter IM-10/UP, one end of the loop is connected to the output of the attenuator and the other end to the control grid of V-301. The attenuated signal from the Signal Generator and the signal received on the antenna are impressed together on the RF amplifier, V-301.

A three-section variable capacitor C-303 tunes the Receiver over the frequency range of 1,550 kc. to 2,500

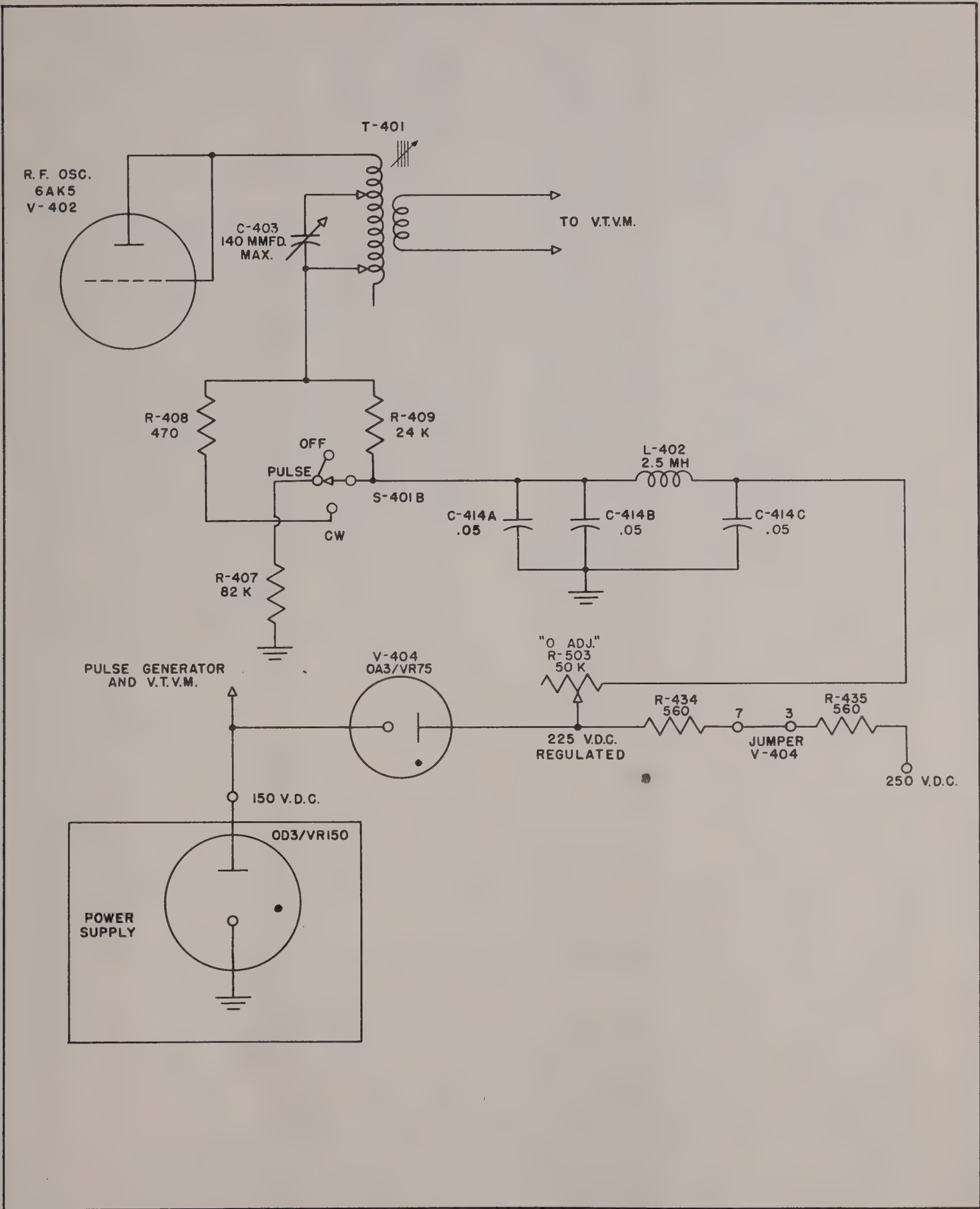

Figure 2–3. Simplified Schematic, Vacuum Tube Voltmeter Zero Adjustment Circuit

kc. Section C-303A tunes the RF amplifier by resonating with the inductance of the Loop Antenna and sections C-303B and C-303C tune the mixer and oscillator, respectively. Variable resistor R-302, *RF Gain,* varies the bias on V-301 and R-317 varies the bias on IF amplifier tubes V-303, V-304 and V-305.

In the Field Intensity Meter IM-14/UP, one end of the Antenna Assembly AS-400/UP winding is connected to ground. The other end is connected to the attenuator through the primary winding of antenna transformer Z-307. Capacitor section C-303A tunes the secondary of Z-307 over the frequency range of 110 kc. to 220 kc. The intermediate frequency stages employ resistance-loaded over-coupled transformers between stages to provide a wide band amplifier. The grid of the triode section of V-306 is directly coupled through resistor R-332 to the diode load resistor R-333 thus providing a diode biased d. c. amplifier which in conjunction with meter M-501 acts as a tuning indicator on CW signals. The output of the amplifier is also connected to Y-1 and Y-2 on the Cathode Ray Indicator Unit terminal board, E-201.

An external indicator or high impedance amplifier may be used for test purposes by connecting it with the video output cable provided in the Field Intensity Meter case cover through J-502 *Video Output* which is coupled to load resistor R-333 through coupling capacitor C-311.

The *CW and Test* meter, M-501, indicates the value of heater and plate voltages in the Receiver when switch S-501 is in the *Heater* or *Plate* positions, respectively. With switch S-501 in the *CW* position, M-501 indicates the level of continuous wave carriers and in the *OFF* position the meter is removed from the circuit.

i. POWER SUPPLY PP-287/U. *(See figure 7-36.)*

(1) This power supply provides 250 and 1,000 VDC and 6.3 V. a. c. or d. c. to operate Field Intensity Meter TS-318/UP or TS-635/UP from a single phase power source supplying 104.5 to 120.5 VAC at 60 ±3 cycles or from the 6-volt storage battery contained in the power supply carrying case. Facilities are also provided for operating this unit from an external 6 VDC source when necessary.

(2) OPERATION FROM 115 VAC. — With switch S-601 in the "115 VAC" position, primary winding 1-2 of transformer T-601 is energized through switch sections S-601E and S-601D, fuses F-603 and F-604, and RF filter chokes L-601 and L-602. These chokes are bypassed to ground by C-601 forming an RF filter. Filament voltage, 6.3 VAC, is supplied to pins B and F on J-602 and the filament terminals of the low voltage rectifier tube, V-602, through the filament transformer, T-602, and switch sections S-601B and S-601C. (See figure 2-4.)

Two secondary windings are provided on T-601. (See figure 7-36.) Secondary 10-11 supplies 1.25 volts at 0.2 amps. for the filament of the high voltage recti-

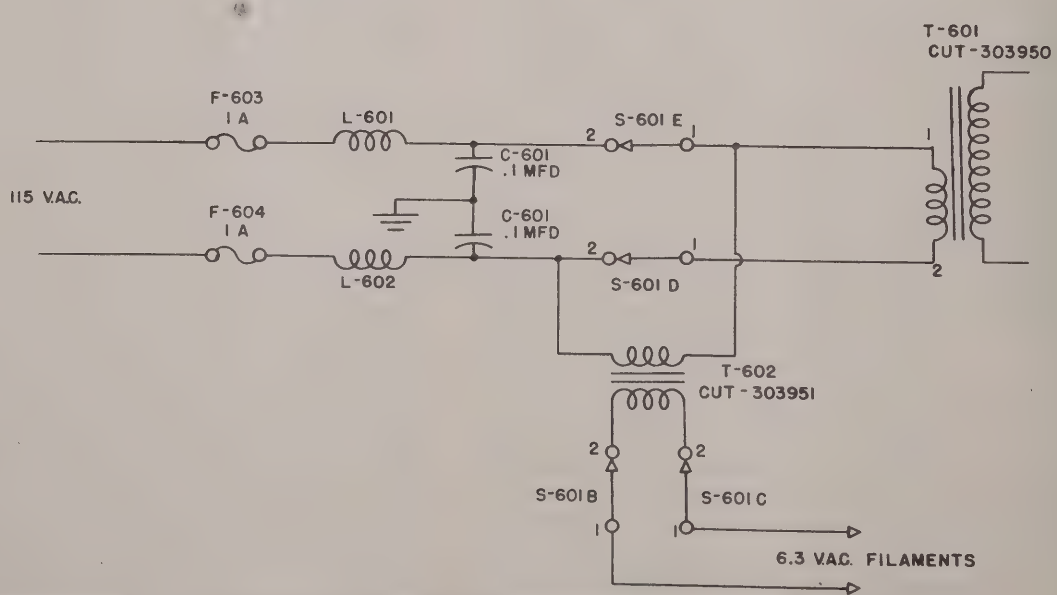

Figure 2–4. Simplified Schematic, Power Supply PP–287/U, Primary Circuit, 115 VAC Operation

fier tube V-601. The second secondary winding, 6-9, supplies 900 VAC at 2 ma. between terminals 7 and 9 for the plate voltage of the half wave high voltage rectifier V-601, and 250 volts at 80 ma. from terminals 6 to 7 and 7 to 8 for the plates of the full wave low voltage rectifier tube V-602. Terminal No. 7 is the center tap of the low voltage part of the winding and is at ground potential.

The d. c. output of the type 8016 high voltage rectifier, V-601, is filtered by capacitor C-606 and passed through the RF inductor, L-606, to terminal D on the power output receptacle, J-602. Resistors R-603 and R-604 in series across the high voltage output act as a "bleeder" resistance for the rectifier and a discharge path for capacitor C-606. Capacitor C-609 provides a path for RF currents to ground.

The output of the 6X5GT/G low voltage rectifier, V-602, is connected by the jumper in V-603 to a capacitor input type of filter consisting of capacitor C-605, filter inductor L-604, and capacitor C-607. A discharge path for C-607 is provided by resistor R-605. An RF filter consisting of inductor L-605 and capacitor C-608 is connected between the "bleeder" resistor, R-605, and terminal E of the power output receptacle, J-602.

The voltage regulator tube OD3/VR-150, V-603, provides regulated 150 VDC as described in Sec. 2-2*c*(5).

(3) OPERATION FROM INTERNAL BATTERY. *(See figure 2-5.)*—The storage battery, BT-601, contained in the same carrying case as the Power Supply Unit but separated from it by a gasketed partition, connects to the power supply by means of two banana plugs and jacks which are disconnected when the power supply is removed from the case. Fuse F-601 protects the vibrator circuit from overload conditions. With the power switch section S-601A set on position 4, "Int. Bat.", 6 volts is applied to the non-synchronous vibrator Y-601. The vibrator supplies an interrupted d. c. voltage to primary 3-5 of T-601 through switch sections S-601F and S-601G. Resistors R-601 and R-602 in conjunction with L-603, C-602, and C-603 eliminate RF or "hash" interference. After the primary of T-601 is energized by the vibrator Y-601, the output circuits of the transformer function the same as on "115 VAC" operation. Capacitor C-604 across the plates of the low voltage rectifier serves as a buffer smoothing sharp voltage peaks.

Filament voltage for V-602 and the voltage applied to terminals B and F of J-602 are supplied by battery BT-601. This circuit is protected by fuse F-602.

(4) OPERATION FROM EXTERNAL BATTERY.—The operation is the same as that described above except that an external 6 V. storage battery is connected to the posts on the Power Supply Unit panel marked "Ext. Input" with the cables supplied in the Power Supply carrying case cover. The power switch should be in the "Ext. Bat." position for this operation.

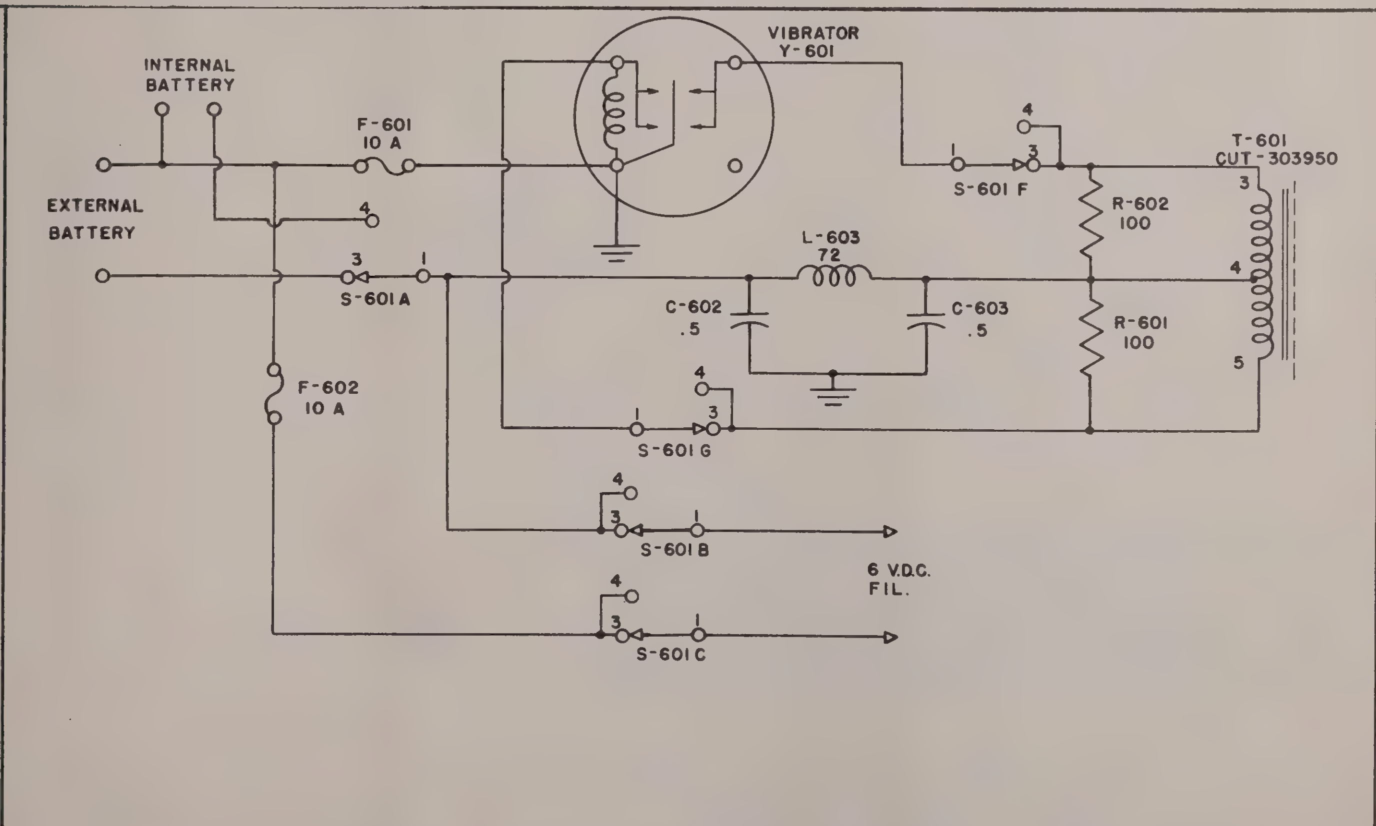

Figure 2–5. Simplified Schematic, Power Supply PP–287/U, Primary Circuit, Battery Operation

SECTION 3
INSTALLATION

1. UNPACKING.

a. Care should be used in unpacking this equipment. Open it from the top side unless otherwise instructed. Use a nail puller to extract all nails when opening the wooden boxes. The equipment and spare parts are packed in sealed moisture-vapor-proof barriers. Cut the seals on the bags approximately one-inch back from the edge and remove the contents. Remove all additional wrappings including dessicants and dehydrating agents.

b. Inspect the equipment for any obvious damage cause by shipping.

2. INSTALLATION.

Field Intensity Meter Equipments TS-318/UP and TS-635/UP are portable test equipments and do not require permanent installation. See figure 3-1 and figure 3-2 for overall and necessary clearance dimensions.

3. INITIAL ADJUSTMENTS.

Electrical adjustments should be checked as described in Section 7.

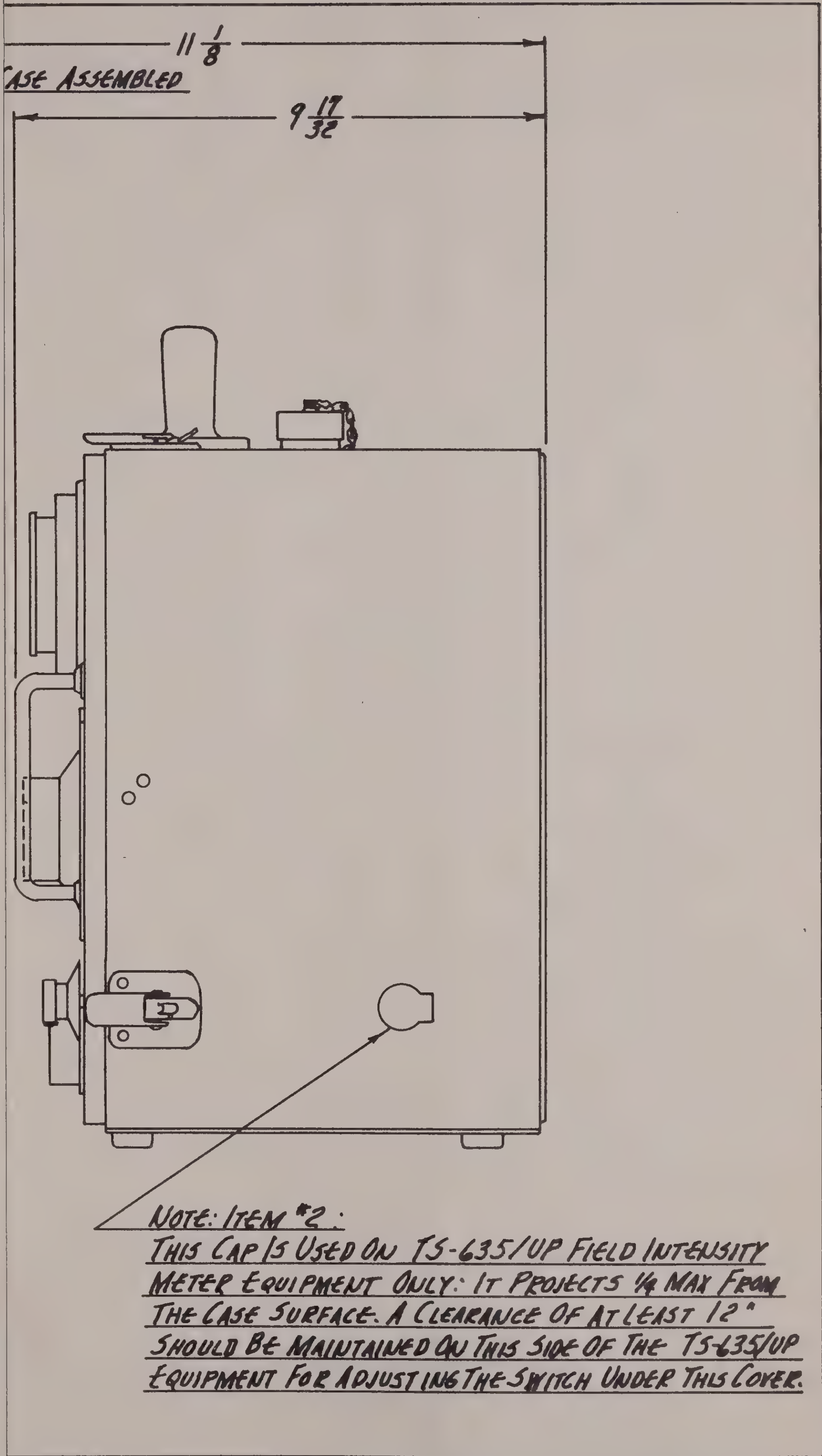

Figure 3-1. Outline Drawing, Field Intensity Meters IM-10/UP or IM-14/UP

SECTION 3
INSTALLATION

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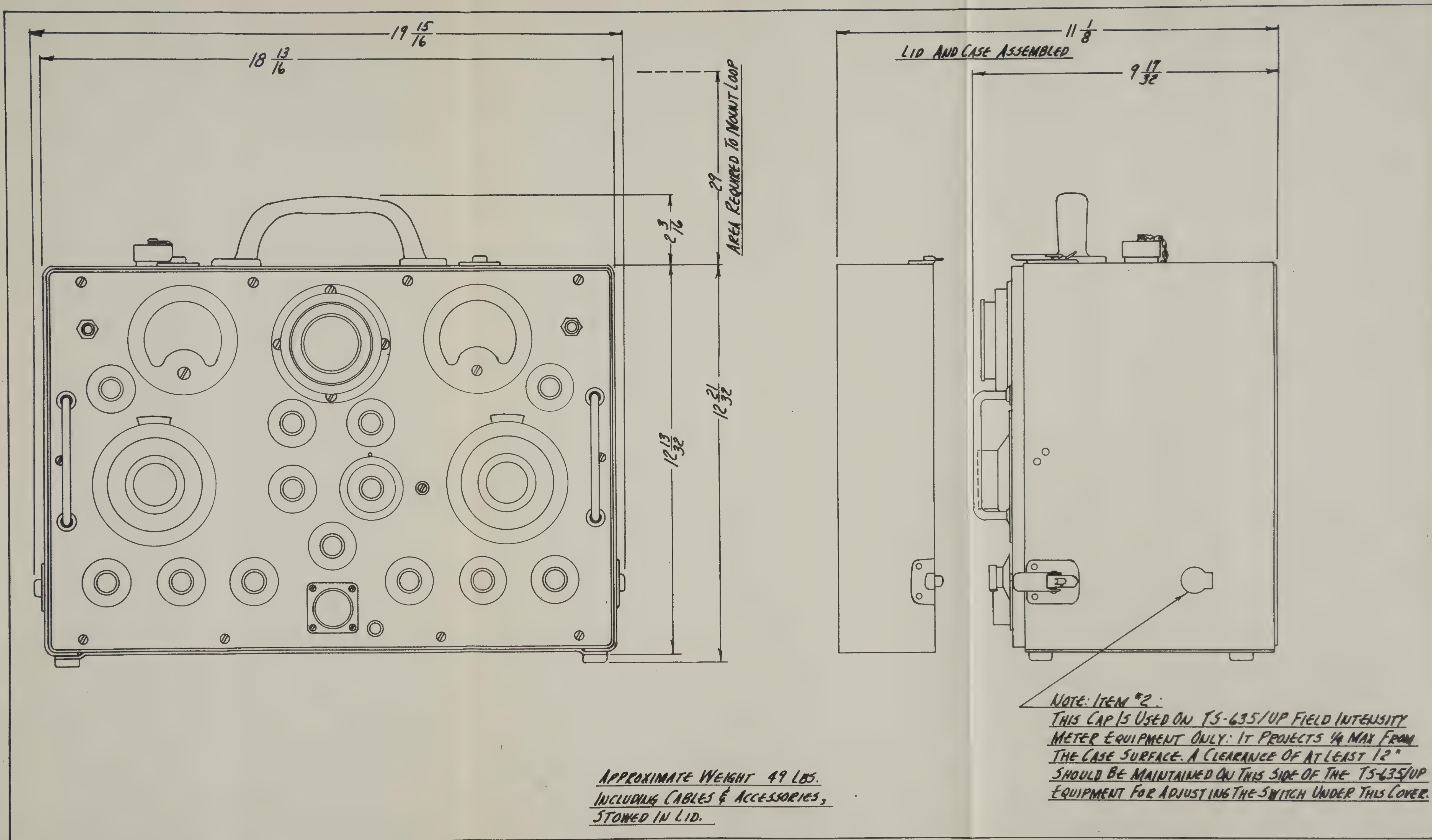

Figure 3-1. Outline Drawing, Field Intensity Meters IM-10/UP or IM-14/UP

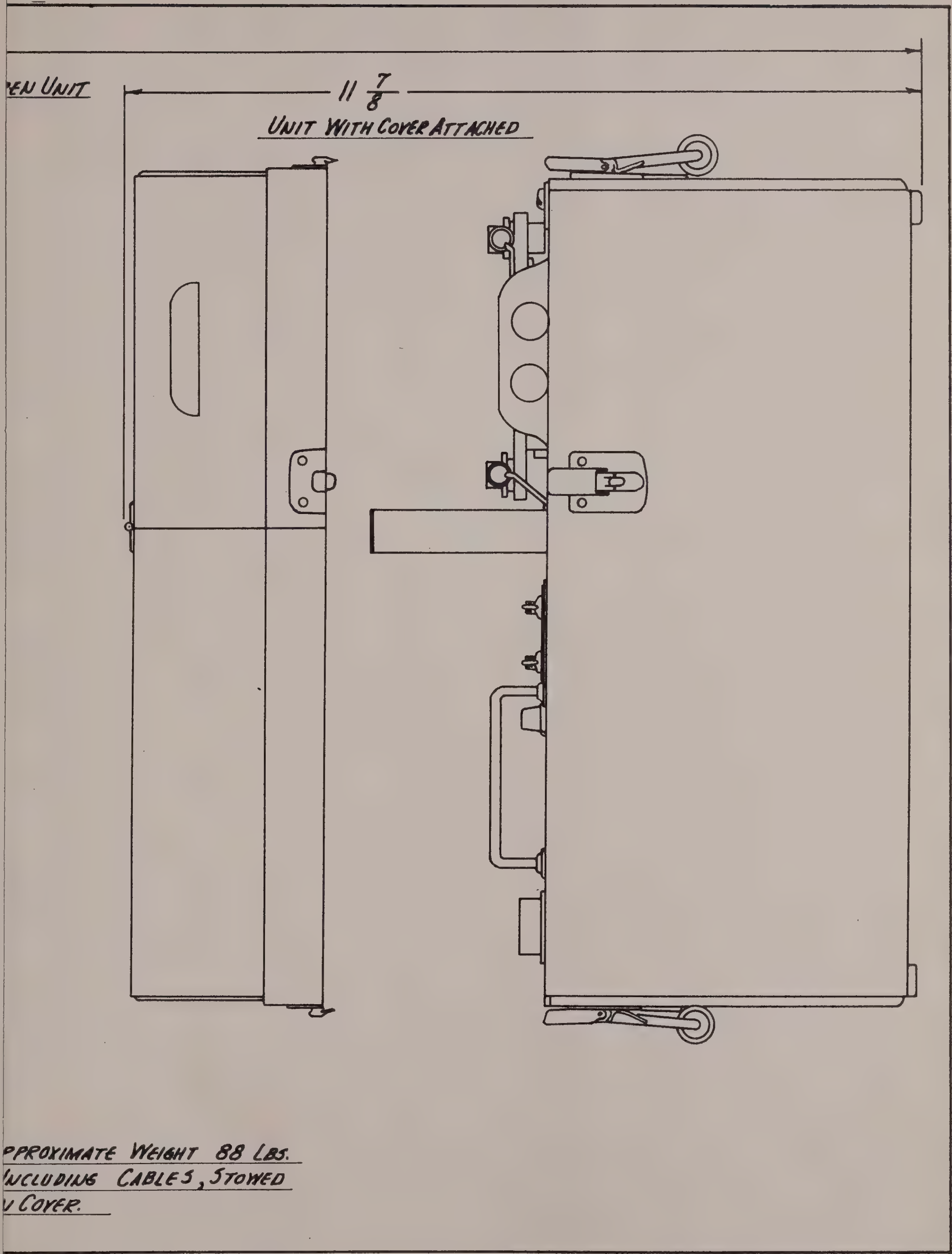

Figure 3-2. Outline Drawing, Power Supply PP-287/U

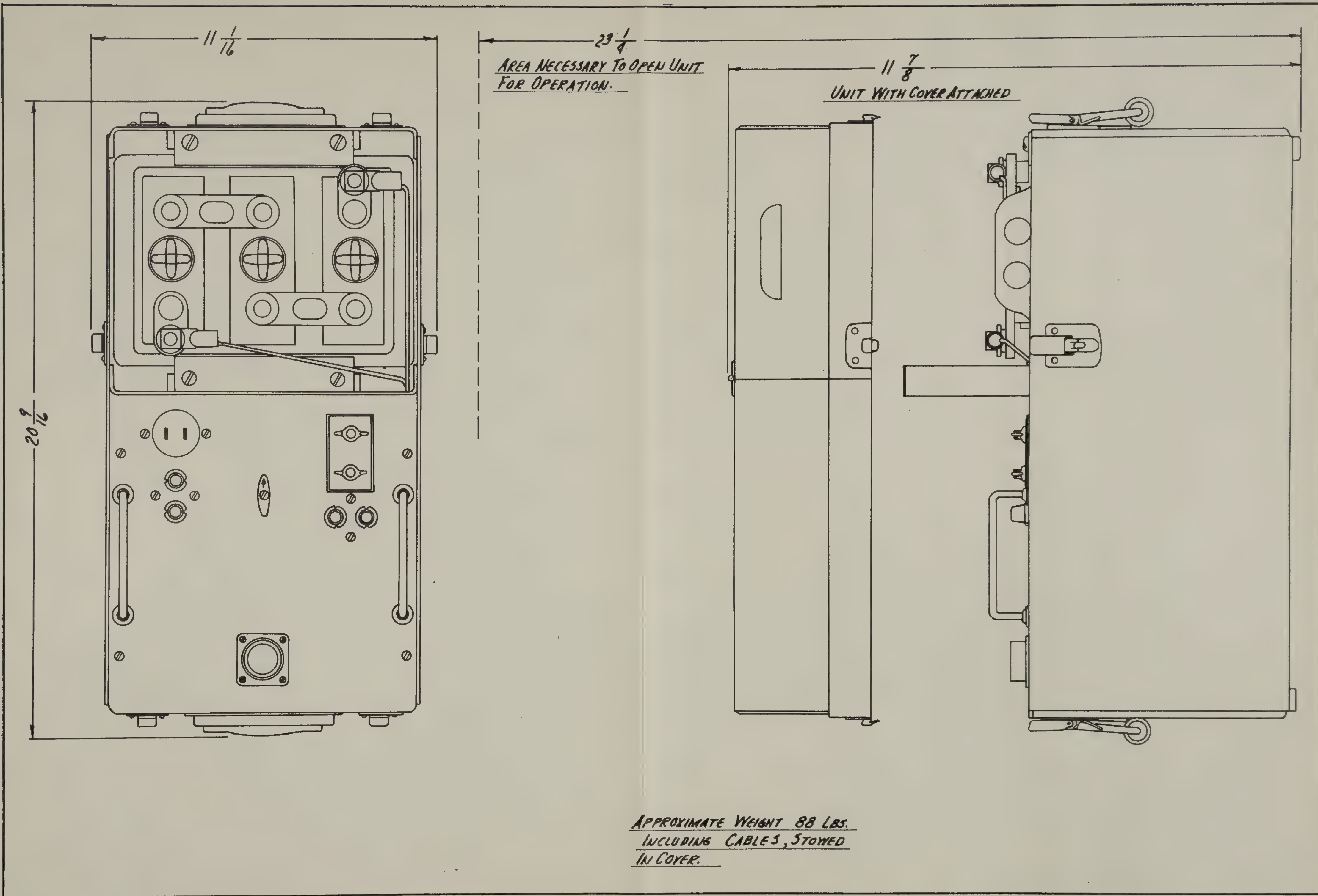

Figure 3-2. Outline Drawing, Power Supply PP-287/U

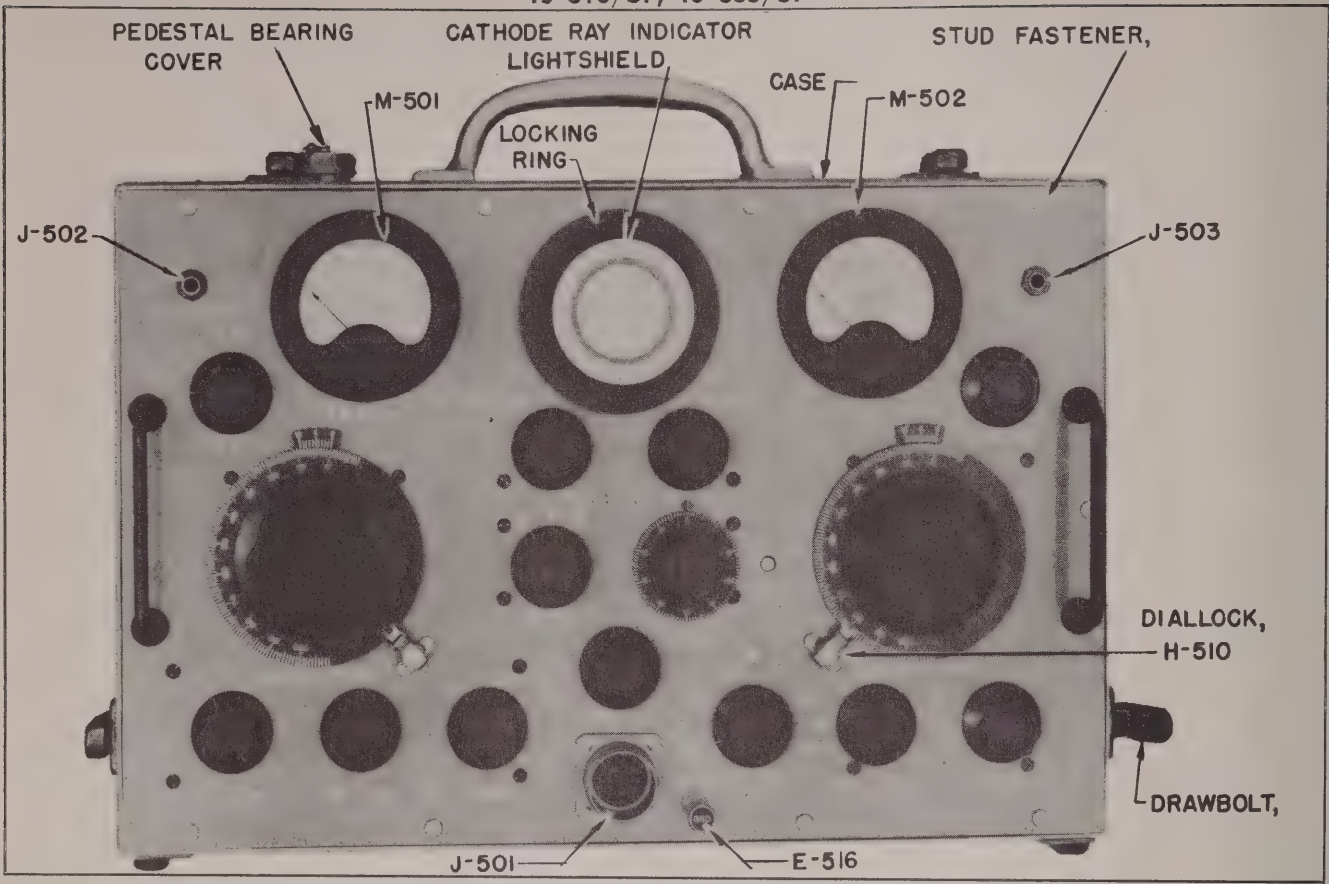

Figure 4-1. Front Panel, Field Intensity Meters IM-10/UP or IM-14/UP

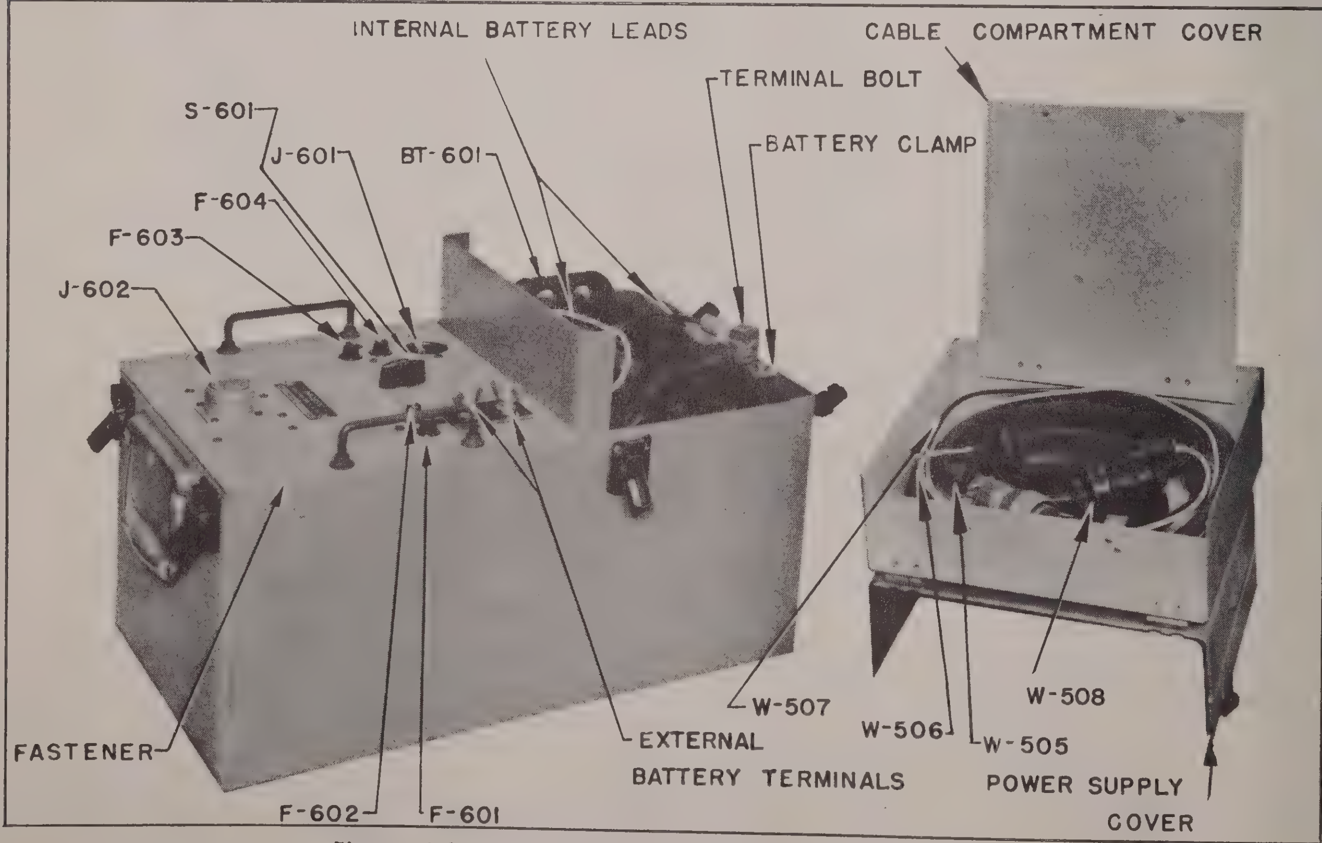

Figure 4-2. Power Supply PP-287/U Cover Removed

SECTION 4
OPERATION

1. GENERAL.

a. For measurement of signals strong enough to be received on the loop antenna, Field Intensity Meters TS-318/UP and TS-635/UP are complete as supplied. For measurement of signals less than approximately 50 microvolts per meter, a vertical antenna, from 10 to 60 feet high, is required. Individual calibration charts are supplied in a frame attached to the case cover of each equipment. Typical charts are included in these instructions. (See figures 4-5, 4-6, 4-7, and 4-8.)

2. PRELIMINARY OPERATIONS.

a. Place the Field Intensity Meter in a position suitable to permit easy access to the controls and a good view of the cathode ray screen. The power supply may be located conveniently anywhere within range of the interconnecting cable.

b. Remove the cover of the Field Intensity Meter and open the power supply cover to permit access to the control panel. (See figure 4-1 and figure 4-2.)

c. Turn the power switch to *OFF.* Connect the Meter and Power Supply together by means of the interconnecting cable and, if outside power source is to be used, connect either the 115-volt line cable or the external battery leads to the Power Supply and to the external supply source.

d. Fasten the loop to the pedestal by the two finger-operated fasteners. Carefully insert the pedestal into receptacle located on top of the Field Intensity Meter case, making sure it is securely seated.

e. A connection to the *Grd* post on the front panel of the Field Intensity Meter must be employed *only* when the equipment is used with a vertical antenna. No connection to this post should be made for loop antenna operation.

f. Turn the power supply switch to the desired power source (115 VAC, Internal Battery or External Battery).

WARNING

Allow the instrument to "warm up" for at least 20 minutes before making any adjustments or measurements otherwise the measurements may be erroneous.

g. Check plate and heater (DC) voltages by means of the *CW and Test* meter and the *Meter* switch. Full scale reading in the *Plate* switch position is 300 volts, normal reading is between 230 and 270 volts. Full scale in the *Heater* position is 10 VDC; normal reading is between 5.4 and 6.4 volts.

WARNING

The heater voltage cannot be read on this meter when the Field Intensity Meter is being operated from a 115 VAC power source. Set the *Meter* switch to "OFF" when the meter is not being used for heater and plate voltage or CW measurements.

h. Adjust cathode ray tube controls, *Intensity* and *Focus,* to give a fine line of suitable brightness. It may be desirable to pull out the lightshade and to snap on the auxiliary eye shield stowed in the Field Intensity Meter cover.

i. Check the calibration of the *Specific PRR* and *Basic PRR* controls as described in Section 7.

WARNING

This calibration should be made frequently in order that there will be no doubt as to the identity of the station whose field intensity is being measured. The *PRR Cal* and *PRR Adj* controls must not be used or disturbed at any time other than when calibrating the pulse recurrence rate system.

3. LORAN SIGNAL MEASUREMENT.

a. Set *Receiver Tuning* to the frequency of the station to be measured, as determined from Calibration Chart No. 7.

b. Adjust the *RF* and *IF Gain* controls to obtain a pulse height of approximately ¾″.

WARNING

Since there is no automatic gain control system incorporated in the receiver, the RF stage will limit when strong signals are applied to it. Operate the *RF Gain* as close to minimum as possible and the *IF Gain* toward its maximum position. In any case, these controls should not be operated at settings higher than necessary to give a good presentation of pulse signals, approximately ¾″ high, on the cathode ray tube screen or no greater than approximately one-half scale reading of the *CW and Test* Meter for CW signals.

c. Adjust the *Basic PRR* and *Specific PRR* controls until the pulses remain stationary on the cathode ray tube screen.

d. Determine the pulse recurrence rate of the signal by obtaining the PRR corresponding to the dial readings from Calibration Chart Table No. 1. (See figures 4-5 and 4-8.)

WARNING

These charts are typical and are not to be used for measurement purposes.

e. Retune *Ant. Trim, Receiver Tuning* and rotate the Loop Antenna for maximum signal; that is, maximum pulse height on the cathode ray tube screen.

f. Determine which of the related pulses is the master or slave pulse. The sequence of pulse transmission of low frequency Loran signals (110 to 220 kc.) consists of transmissions by two station pairs at the same recurrence rate except that on every third transmission cycle the master station signal of one pair is shifted 1,000 usec. producing a "ghost" signal whereas high frequency Loran (1,550 to 2,500 kc.) usually consists of just one station pair. Since these differences exist, the method of pulse identification when using Field Intensity Meter TS-318/UP is different from that used with Field Intensity Meter TS-635/UP. If either field intensity meter is close to a station, either master or slave, the pulse produced by that station can be easily identified by the high field intensity.

(1) When Field Intensity Meter TS-318/UP is being used, the following rule is to be used for pulse identification:

If the spacing between the two related pulses is *greater* than one-half of the base line length, the slave pulse is on the *right.* If the spacing is *less* than one-half of the base line, the slave pulse is on the *left.*

(2) When Field Intensity Meter TS-635/UP is being used, the identification procedure is as follows:

(a) By means of the *Specific PRR* control allow the pulses to "slip" on the cathode ray screen until the master and its "ghost" is on the extreme left-hand end of the base line. The pulses will appear as in Figure 4-3.

Z—First master pulse in normal position.
Z_1—First master pulse shifted 1,000 usec. on every third cycle.
X—Second master pulse.
Y—Slave Station signal associated with Z.
W—Slave Station signal associated with X.

Figure 4–3. Pulse Sequence, Field Intensity Meter TS–635/UP

(b) To identify a particular station in the group rotate the loop until one of the pulses decreases to minimum. Then the direction of the station radiating that pulse will be on a line perpendicular to the plane of the loop. Knowing the direction of the station to be measured from the position of the field intensity meter the operator may determine whether it is the station to be measured.

(c) When the station has been identified, rotate the loop antenna for maximum pulse height so that its field intensity may be measured.

g. Set *Selector* switch to "pulse" and tune *Generator Tuning* to the dial setting corresponding to the frequency of the station being measured. See Calibration Chart No. 8.

h. Turn the *RF Level* control to the extreme counter-clockwise position and set the *RF Level* meter to "0" by means of the *Zero Adj.* knob. Tap the meter to minimize bearing friction error.

i. Turn the *RF Level* control clockwise and check *Generator Tuning* for maximum pulse height.

j. Adjust the *RF Level* and *Multiply By* controls until the calibrating pulse and the pulse to be measured are the same height.

Note

IF THE 100K POSITION OF THE *MULTIPLY BY* DIAL IS USED, RECHECK THE "0" ADJUSTMENT AS IN STEP *h.*

k. Determine the field intensity. See Sec. 4-6*b* and 4-6*c*.

4. TO MEASURE A CW SIGNAL.

a. Set *Selector* to "OFF." Set *Meter* switch to "CW" and *Multiply By* dial to position "1" (or any position other than "100K").

b. Adjust *Receiver Tuning* for a dip of the *CW and Test* meter at the dial setting corresponding to the frequency of the station to be measured. See Calibration Chart No. 7.

c. Rotate the Loop Antenna and adjust the *Ant. Trim.* for further dip.

d. Adjust the *RF* and *IF Gain* controls for a convenient meter reading of approximately ½ scale, recheck the *Receiver Tuning* and *Ant. Trim.,* and note the meter reading.

e. Rotate the Loop Antenna for maximum reading of the *CW and Test* meter.

f. Set the *Selector* switch to "CW," turn the *RF Level* control to the extreme counterclockwise position and set the *RF Level* meter to "0" by means of the *Zero Adj.* knob. Tap the meter to minimize bearing friction error.

g. Rotate the *Generator Tuning* for a dip in indication of the *CW and TEST* meter at the dial setting corresponding to the station RF frequency. See Calibration Chart No. 8.

h. Adjust the *RF Level* and *Multiply By* controls until the *CW and Test* meter reads the same as in Sec. 4-4*d*. DO NOT CHANGE THE *RF* AND *IF GAIN* controls. Recheck the *Generator Tuning* for maximum meter dip. If the "100K" position of the *Multiply By* dial is used, recheck step *d* while the switch is in this position.

i. Compute the field intensity. See Sec. 4-6*b* and 4-6*c*.

5. TO MEASURE LORAN OR CW SIGNALS USING A VERTICAL ANTENNA.

a. Place the equipment, using the Loop Antenna, in operation as close to the vertical antenna as possible. See Sec. 4-2.

b. Set *Selector* and *Meter* switches to "OFF" and *Multiply By* dial to "1."

c. Tune *Receiver Tuning* to a low-powered local oscillator set up approximately ½ mile from the Field Intensity Meter and on the same frequency as the station to be measured.

d. If the test signal is Loran or pulse, measure and compute the field intensity as in Sec. 4-3. If the signal is CW, measure and compute as in Sec. 4-4.

e. Turn the power switch to "OFF" and remove the Loop Antenna and pedestal from its receptacle.

f. Disconnect the Loop Antenna from the pedestal by loosening the two wing-type finger-operated fasteners.

g. Plug the Antenna Coupler in place of the Loop Antenna on the pedestal and lock it in place with the wing-type finger-operated fasteners. (See figure 4-4.)

h. Re-insert the pedestal into the receptacle and connect the vertical antenna to one of the spring type binding posts A-1, A-2, or A-3 on top of the Antenna Coupler. Long antennas should be attached to A-1, intermediate length antennas to A-2 and short antennas to A-3.

i. Turn the power switch to the type of power being used and retune *Receiver Tuning* to the test signal frequency to be measured.

j. Increase *RF* and *IF Gain* controls and tune the Antenna Coupler by turning the phenolic rod on the top of the coupler for a dip in the *CW and Test* meter reading or for an increase in the height of the signal on the cathode ray tube. If no tuning indication is obtained, connect the antenna to one of the remaining terminals and repeat the tuning procedure.

k. Obtain the *RF Level* and *Multiply By* dial readings as described in Sec. 4-3 if the test signal is Loran (pulse), or as in Sec. 4-4 if the signal is CW.

Note

IF THE TEST SIGNAL IS CW, IT WILL BE NECESSARY TO TURN THE TEST TRANSMITTER OFF AFTER THE FIELD INTENSITY METER IS TUNED TO THE SIGNAL AND THE *CW AND TEST* METER READING IS NOTED.

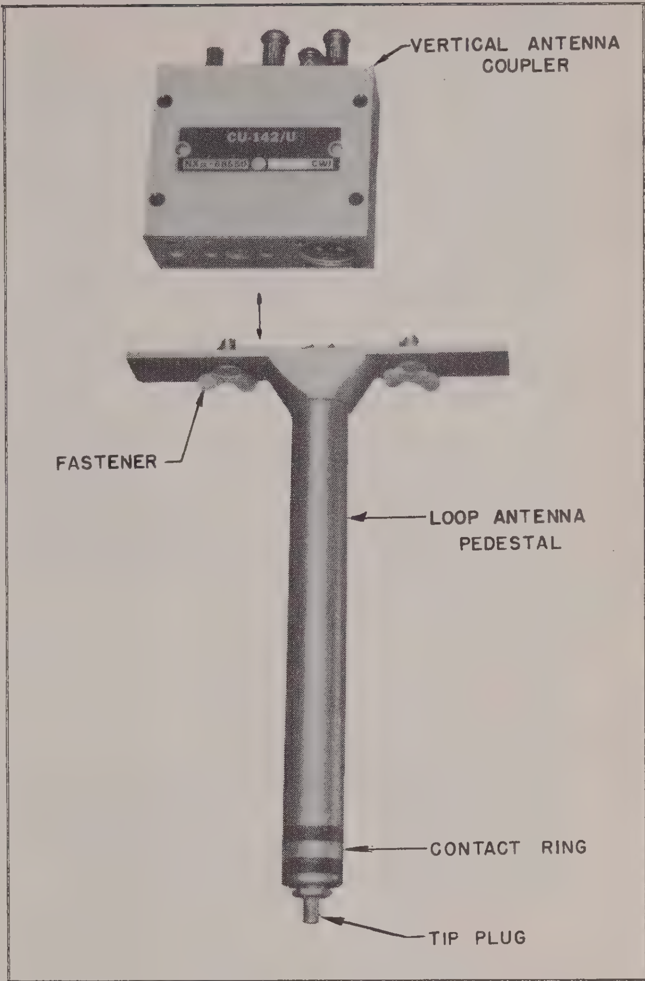

Figure 4–4. Alignment View, Antenna Coupler CU–142/U or CU–155/UP and Pedestal

l. Compute the Vertical Antenna Factor in accordance with Sec. 4-6*d*(1).

m. Retune *Receiver Tuning* to frequency of the station to be measured.

n. Obtain *RF Level* and *Multiply By* dial readings as described in Sec. 4-3 for Loran (pulse) or as described in Sec. 4-4 for CW signals.

o. Compute the field intensity as shown in 4-6*d*(2).

6. COMPUTATIONS.

a. GENERAL.

(1) Field Intensity Meter TS-318/UP is supplied with field intensity meter calibrations, applicable for Loran (pulse) or CW signals, for RF frequencies of 1,750, 1,800, 1,850, 1,900 and 1,950 kc. 2(See figure 4-6 for a typical chart.)

(2) Field Intensity Meter TS-635/UP is supplied with a similar calibration on one RF frequency, 180 kc. (See figure 4-7 for a typical chart.)

(3) The charts, which are to be used in the following computations, are contained in a frame attached to the cover of the respective equipments.

b. FOR SIGNALS ON CALIBRATED RF FREQUENCIES.

(1) From the proper calibration curve determine the field intensity corresponding to the *RF Level* meter reading.

(2) Multiply this field intensity value by the *Multiply By* factor from Sec. 4-3*j* and 4-4*b* to obtain the true field intensity of the signal.

c. FOR SIGNALS ON UNCALIBRATED RF FREQUENCIES.

(1) From the Vacuum Tube Voltmeter calibration, Chart No. 6, obtain "microvolts" value corresponding to *RF Level* meter reading.

(2) From the Loop Antenna Factor calibration, Chart No. 9, obtain the Loop Factor (K) corresponding to the RF frequency.

(3) Substitute these values and the *Multiply By* factor in the following formula to obtain the field intensity of the signal:

$$\text{Field Intensity (microvolts per meter)} = \frac{A \times B \times C}{\text{frequency in mcs.}}$$

where

A = Microvolts from Sec. 4-6*c*(1)
B = *Multiply By* factor from Sec. 4-3*j* and 4-4*b*
C = Loop Factor (K) from Sec. 4-6*c*(2).

d. FOR MEASUREMENTS WHEN USING A VERTICAL ANTENNA.

(1) COMPUTATION OF THE VERTICAL ANTENNA "K" FACTOR.

(a) From the Vacuum Tube Voltmeter calibration, Chart No. 6, determine the "microvolts" value corresponding to the *RF Level* meter reading from Sec. 4-5*k*.

(b) Substitute the values in the following formula to determine the Vertical Antenna Factor:

$$K_v = \text{Vertical Antenna Factor} = \frac{E}{A \times B}$$

where

A = Microvolts from Sec. 4-6*d*(1)*(a)*
B = *Multiply By* factor from Sec. 4-5*k*.
E = Field Intensity obtained from Loop Antenna measurements in Sec. 4-5*d*.

(2) COMPUTATION OF THE FIELD INTENSITY.

(a) From the Vacuum Tube Voltmeter Calibration Chart No. 6, determine the "microvolts" value corresponding to the *RF Level* meter reading from Sec. 4-5*n*.

(b) Substitute values in the following formula to determine the field intensity:

$$\text{Field Intensity (microvolts per meter)} = A_v \times B_v \times K_v$$

A_v = Microvolts from Sec. 4-6*d*(2)*(a)*
B_v = *Multiply By* factor from Sec. 4-5*n*
K_v = Vertical Antenna factor from Sec. 4-5*l*

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HARTS AND DATA

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ATING INSTRUCTIONS

switch to "OFF". Connect Power
r with interconnecting cable.
pedestal and insert into receptacle
.
ost on Field Intensity Meter panel.
tor switch to type of power being

Power Supply use with **115 VAC** or

up" before measuring.
te voltage with **CW and Test** meter
ration, check plate and heater volt-
230 to 270 volts, full scale-300 volts;
lc-10 volts.
witch to "OFF".
s controls for suitably bright, fine

d **Multiply By** dial to "1".
station. See Chart #7.
fic **PRR** to PRR of known station.

ontrols until pulses can be seen on

es are stationary.
requency of station to be measured.
ntrols until pulse height is approxi-

close to minimum as possible. See

h. Adjust **Basic PRR** and **Specific PRR** until pulses are stationary. The Signal PRR is obtained from Chart Table #1 corresponding to PRR dial readings.

i. Rotate **Loop, Ant. Trim** and **Receiver Tuning** to peak signal.

j. Determine master-slave relationship. If spacing between two related pulses is greater than half the base line, the slave pulse is on the **right**. If spacing between pulses is less than half of the base line, the slave is on the **left**.

k. Tune **Generator Tuning** to signal frequency. See Chart #8.

l. Set **Selector** to "Pulse" and rotate **RF Level** control to extreme counterclockwise position. Set **RF Level** to "O" with **Zero Adj.** control.

m. Adjust **Multiply By, RF Level** and **Generator Tuning** controls until signal and generator pulses are same height.

n. Use **RF Level** and **Multiply By** readings to determine Field Intensity. See reverse side.

3. To Measure CW Signals.

a. Set **Meter** switch to "CW" and **Selector** switch to "OFF".

b. Adjust **Receiver Tuning** to station frequency. See Chart #7. Tune for **CW and Test** meter dip.

c. Rotate Loop Antenna and adjust **Ant. Trim.** for further dip. Adjust **RF** and **IF Gain** controls for convenient meter reading.

d. Rotate Loop Antenna for maximum reading of **CW and Test** meter.

e. Turn **Selector** to "CW" and check zero setting of **RF Level** meter as in par. 2(1).

f. Rotate **Generator Tuning** for maximum **CW and Test** meter dip at dial setting corresponding to station RF frequency. See Chart #8.

g. Adjust **RF Level** and **Multiply By** controls until **CW and Test** meter reads same as in 3(c). DO NOT CHANGE **RF** AND **IF GAIN** CONTROLS. Recheck **Generator Tuning** dip.

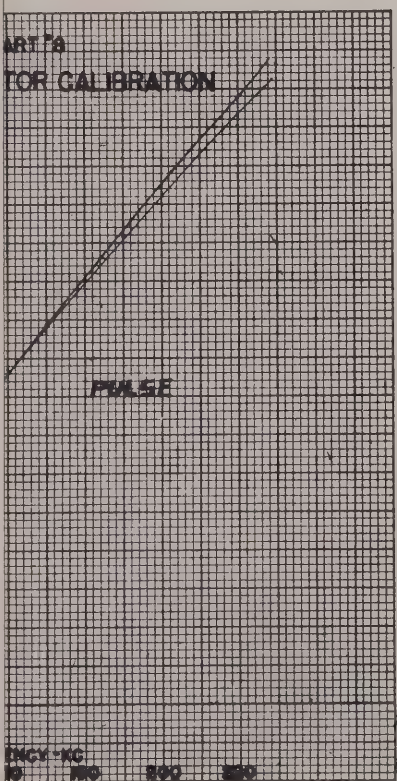
h. Use **RF Level** and **Multiply By** readings to compute field intensity. See reverse side.

4. See Instruction Book for Operation with Vertical Antenna.

CHART TABLE No. 1

"SPECIFIC PRR" DIAL READINGS

	S-Rate	L-Rate	H-Rate
0	10.0	10.0	10.0
1	17.50	20.5	22.50
2	24.00	27.5	34.00
3	30.0	34.7	44.50
4	37.0	42.75	55.00
5	43.0	50.0	66.70
6	50.0	58.0	77.50
7	56.0	65.0	88.50



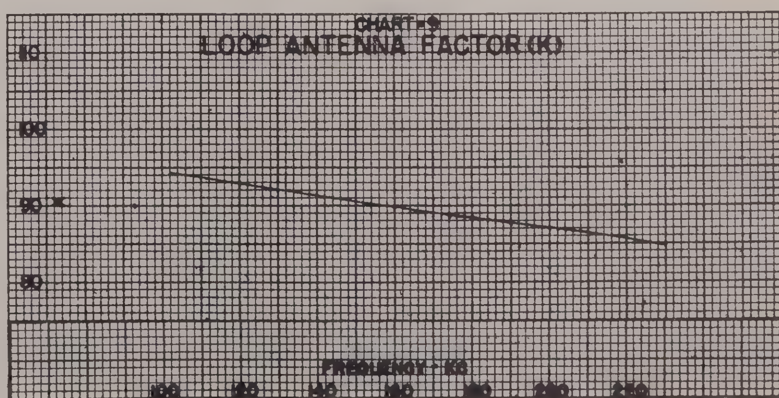


Figure 4-5. Typical Calibration Charts No. 6 through No. 9, TS-318/UP
(Not to be used for measurement purposes)

b. FOR SIGNALS ON CALIBRATED RF FREQUENCIES.

(1) From the proper calibration curve determine the field intensity corresponding to the *RF Level* meter reading.

(2) Multiply this field intensity value by the *Multiply By* factor from Sec. 4-3*j* and 4-4*b* to obtain the true field intensity of the signal.

c. FOR SIGNALS ON UNCALIBRATED RF FREQUENCIES.

(1) From the Vacuum Tube Voltmeter calibration, Chart No. 6, obtain "microvolts" value corresponding to *RF Level* meter reading.

(2) From the Loop Antenna Factor calibration, Chart No. 9, obtain the Loop Factor (K) corresponding to the RF frequency.

(3) Substitute these values and the *Multiply By* factor in the following formula to obtain the field intensity of the signal:

$$\text{Field Intensity (microvolts per meter)} = \frac{A \times B \times C}{\text{frequency in mcs.}}$$

where

A = Microvolts from Sec. 4-6*c*(1)
B = *Multiply By* factor from Sec. 4-3*j* and 4-4*b*
C = Loop Factor (K) from Sec. 4-6*c*(2).

d. FOR MEASUREMENTS WHEN USING A VERTICAL ANTENNA.

(1) COMPUTATION OF THE VERTICAL ANTENNA "K" FACTOR.

(a) From the Vacuum Tube Voltmeter calibration, Chart No. 6, determine the "microvolts" value corresponding to the *RF Level* meter reading from Sec. 4-5*k*.

(b) Substitute the values in the following formula to determine the Vertical Antenna Factor:

$$K_v = \text{Vertical Antenna Factor} = \frac{E}{A \times B}$$

where

A = Microvolts from Sec. 4-6*d*(1)*(a)*
B = *Multiply By* factor from Sec. 4-5*k*.
E = Field Intensity obtained from Loop Antenna measurements in Sec. 4-5*d*.

(2) COMPUTATION OF THE FIELD INTENSITY.

(a) From the Vacuum Tube Voltmeter Calibration Chart No. 6, determine the "microvolts" value corresponding to the *RF Level* meter reading from Sec. 4-5*n*.

(b) Substitute values in the following formula to determine the field intensity:

$$\text{Field Intensity (microvolts per meter)} = A_v \times B_v \times K_v$$

A_v = Microvolts from Sec. 4-6*d*(2)*(a)*
B_v = *Multiply By* factor from Sec. 4-5*n*
K_v = Vertical Antenna factor from Sec. 4-5*l*

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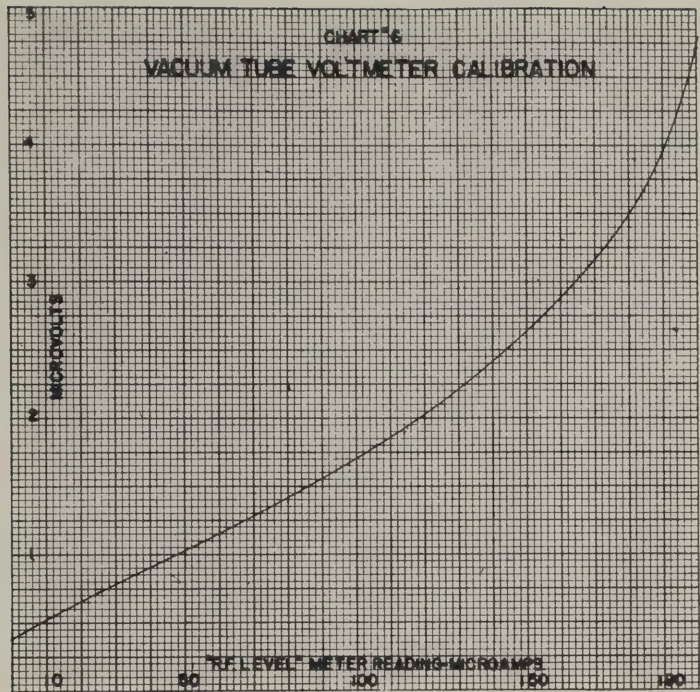
CALIBRATION CHARTS AND DATA



CONDENSED OPERATING INSTRUCTIONS

1. **Preliminary**

a. Set Power Supply selector switch to "OFF". Connect Power Supply to Field Intensity Meter with interconnecting cable.

b. Fasten Loop Antenna to pedestal and insert into receptacle on top of Field Intensity Meter.

c. Attach a good ground to post on Field Intensity Meter panel.

d. Turn Power Supply selector switch to type of power being used.

Note: Cables provided for Power Supply use with **115 VAC** or **EXT. BAT.**

e. Allow 20 minutes "warm-up" before measuring.

f. On AC operation, check plate voltage with **CW and Test** meter and Meter switch. On DC operation, check plate and heater voltages. Normal readings: Plate-230 to 270 volts, full scale-300 volts; Heater-5.4 to 6.4 volts, full scale-10 volts.

g. Set **CW and Test** meter switch to "OFF".

h. Adjust **Intensity** and **Focus** controls for suitably bright, fine line on Cathode Ray Tube.

2. **To Measure Loran Signals**

a. Set **Selector** to "OFF", and **Multiply By** dial to "1".

b. Tune Receiver to a known station. See Chart #7.

c. Set **Basic PRR** and **Specific PRR** to PRR of known station. See Chart Table #1.

d. Adjust **RF** and **IF Gain** controls until pulses can be seen on CR tube.

e. Adjust **PRR Cal** until pulses are stationary.

f. Tune **Receiver Tuning** to frequency of station to be measured.

g. Adjust **RF** and **IF Gain** controls until pulse height is approximately ¾".

Note: Operate RF gain as close to minimum as possible. See Instruction Book.

h. Adjust **Basic PRR** and **Specific PRR** until pulses are stationary. The Signal PRR is obtained from Chart Table #1 corresponding to PRR dial readings.

i. Rotate **Loop, Ant. Trim** and **Receiver Tuning** to peak signal.

j. Determine master-slave relationship. If spacing between two related pulses is greater than half the base line, the slave pulse is on the **right**. If spacing between pulses is less than half of the base line, the slave is on the **left**.

k. Tune **Generator Tuning** to signal frequency. See Chart #8.

l. Set **Selector** to "Pulse" and rotate **RF Level** control to extreme counterclockwise position. Set **RF Level** to "O" with **Zero Adj.** control.

m. Adjust **Multiply By, RF Level** and **Generator Tuning** controls until signal and generator pulses are same height.

n. Use **RF Level** and **Multiply By** readings to determine Field Intensity. See reverse side.

3. **To Measure CW Signals.**

a. Set **Meter** switch to "CW" and **Selector** switch to "OFF".

b. Adjust **Receiver Tuning** to station frequency. See Chart #7. Tune for **CW and Test** meter dip.

c. Rotate Loop Antenna and adjust **Ant. Trim.** for further dip. Adjust **RF** and **IF Gain** controls for convenient meter reading.

d. Rotate Loop Antenna for maximum reading of **CW and Test** meter.

e. Turn **Selector** to "CW" and check zero setting of **RF Level** meter as in par. 2(1).

f. Rotate **Generator Tuning** for maximum **CW and Test** meter dip at dial setting corresponding to station RF frequency. See Chart #8.

g. Adjust **RF Level** and **Multiply By** controls until **CW and Test** meter reads same as in 3(c). DO NOT CHANGE **RF** AND **IF GAIN** CONTROLS. Recheck **Generator Tuning** dip.

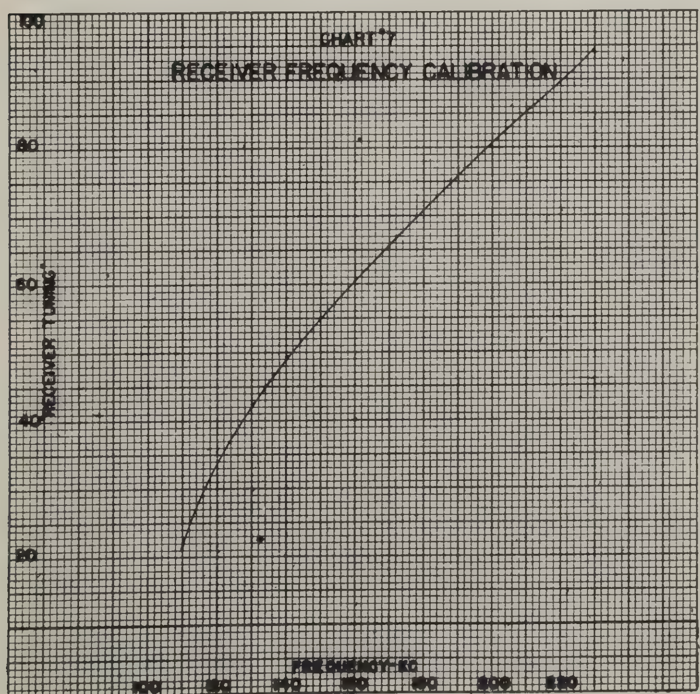
h. Use **RF Level** and **Multiply By** readings to compute field intensity. See reverse side.

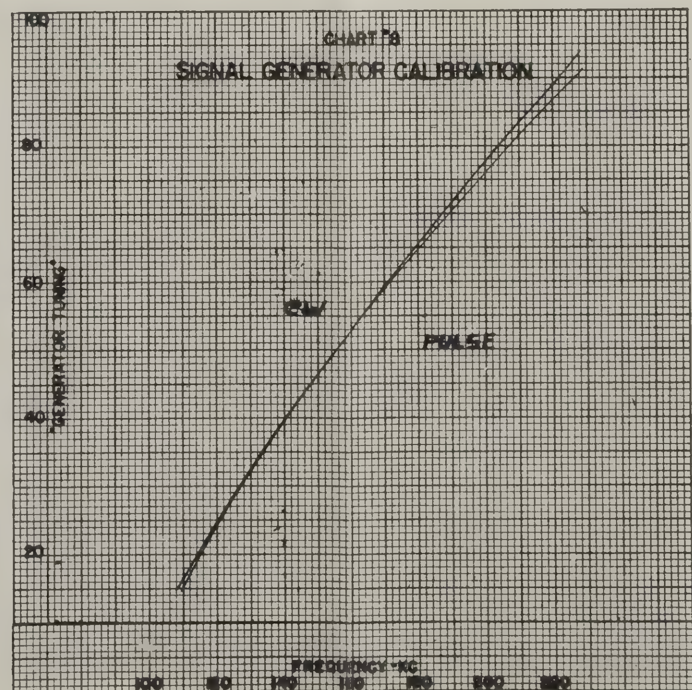
4. **See Instruction Book for Operation with Vertical Antenna.**

CHART TABLE No. 1

"SPECIFIC PRR" DIAL READINGS

	S-Rate	L-Rate	H-Rate
0	10.0	10.0	10.0
1	17.50	20.5	22.50
2	24.00	27.5	34.00
3	30.0	34.7	44.50
4	37.0	42.75	55.00
5	43.0	50.0	66.70
6	50.0	58.0	77.50
7	56.0	65.0	88.50





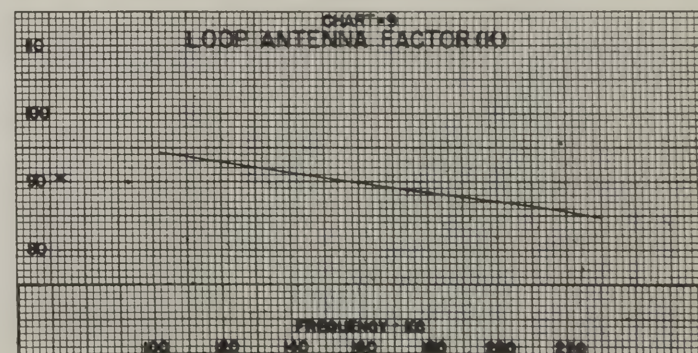
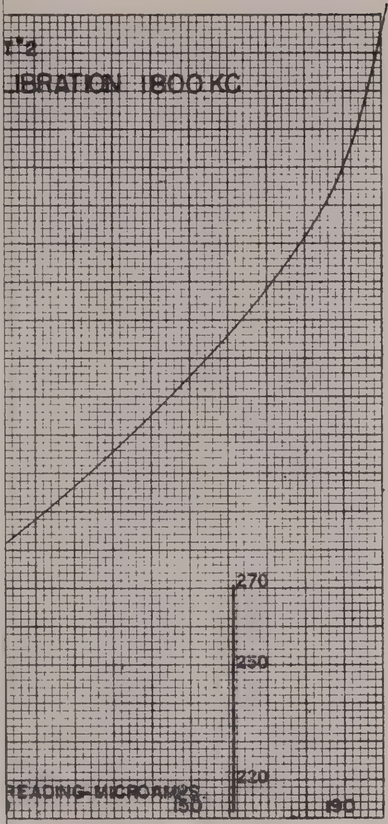
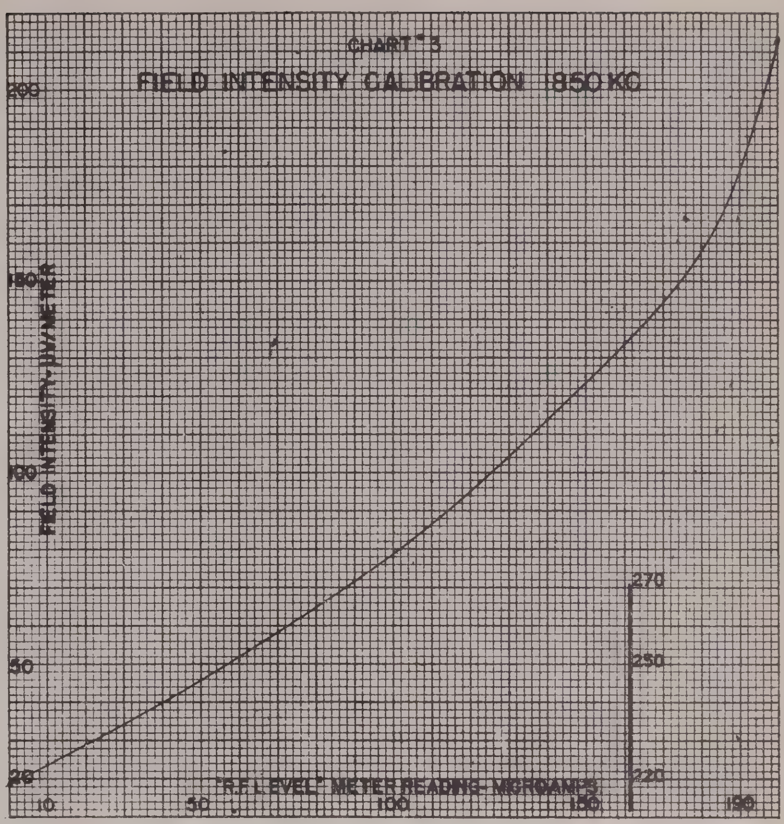
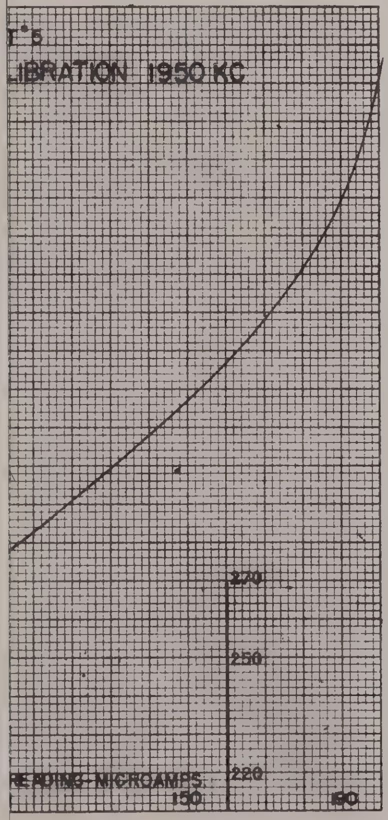


Figure 4-5. Typical Calibration Charts No. 6 through No. 9, TS-318/UP
(Not to be used for measurement purposes)







USE OF CALIBRATION CURVES AND COMPUTATIONS

1. **For Calibrated RF Frequencies** (Loran and CW Signals).

a. From proper calibration curve, Chart #1 through #5, determine Field Intensity corresponding to **RF LEVEL** meter reading obtained in par. 2(n) and 3(h) on reverse side.

b. Apply **Multiply By** factor to this field intensity to obtain true signal field intensity.

2. **For Uncalibrated RF Frequencies.**

a. From Vacuum Tube Voltmeter calibration, Chart #6, obtain "Microvolts" value corresponding to **RF Level** meter reading.

b. From Loop Antenna Factor curve, Chart #9, obtain Loop Factor (K) corresponding to the RF frequency.

c. Substitute values in following formula to obtain field intensity:

$$\text{Field Intensity} = \mu\text{ volts/meter} = \frac{A \times B \times C}{\text{Frequency in MC.}}$$

A = Microvolts from 2a
B = **Multiply By** setting
C = Loop Factor (K) from 2b

3. For computations when using vertical antenna, see Instruction Book.

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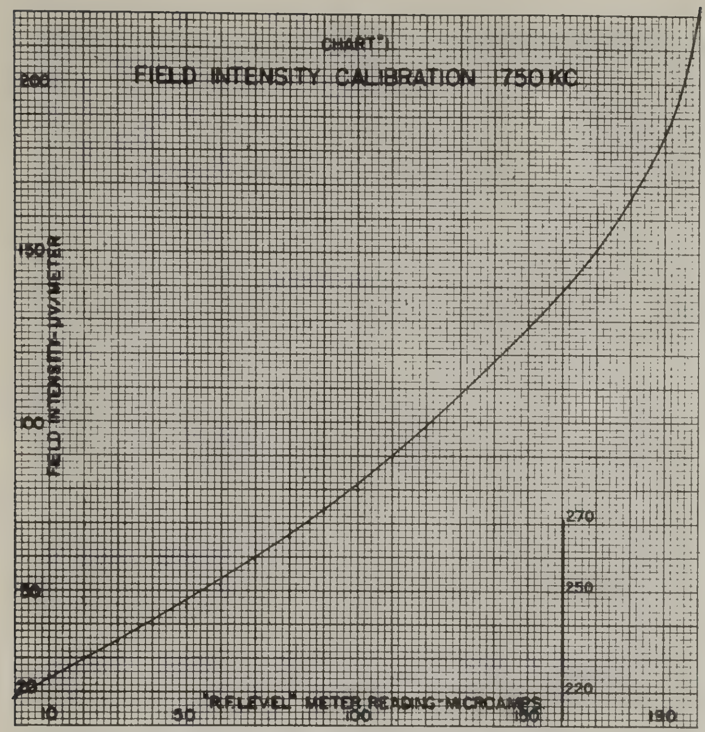
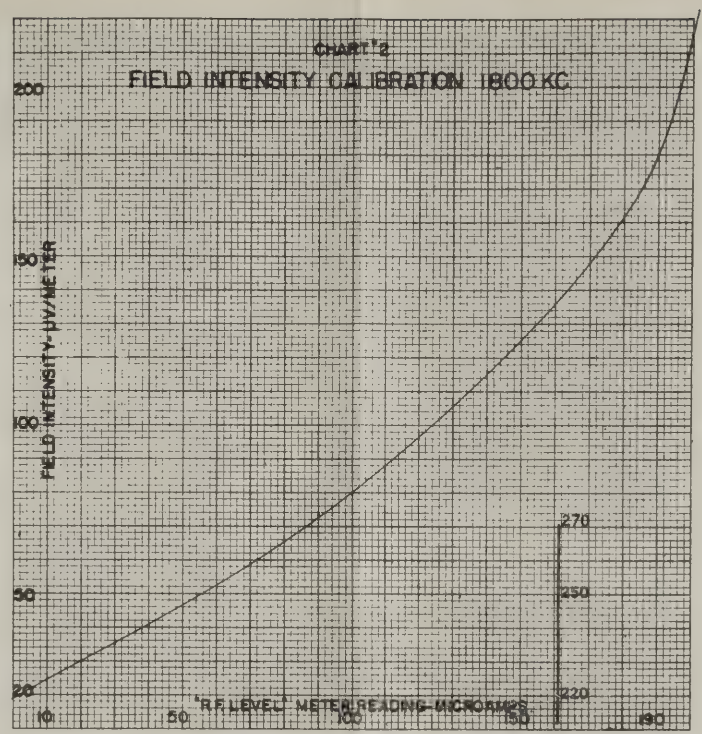
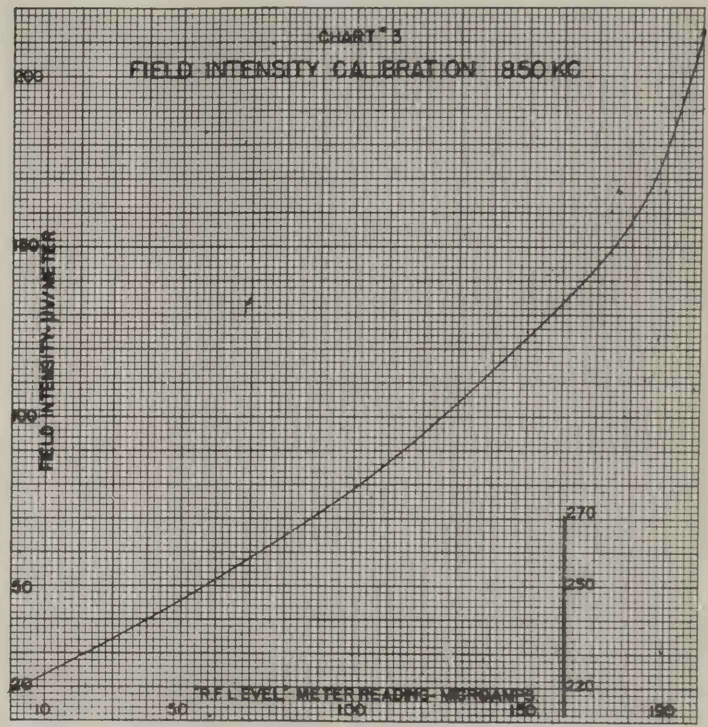
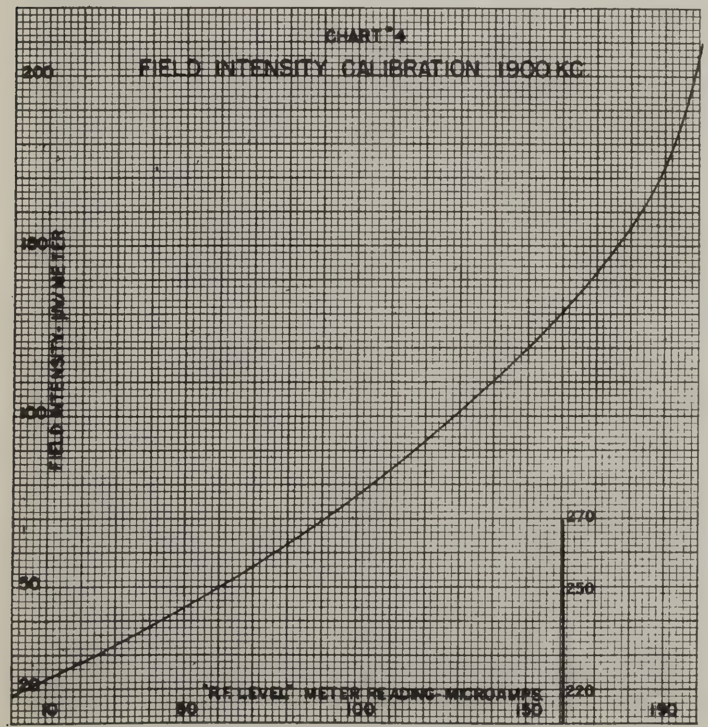
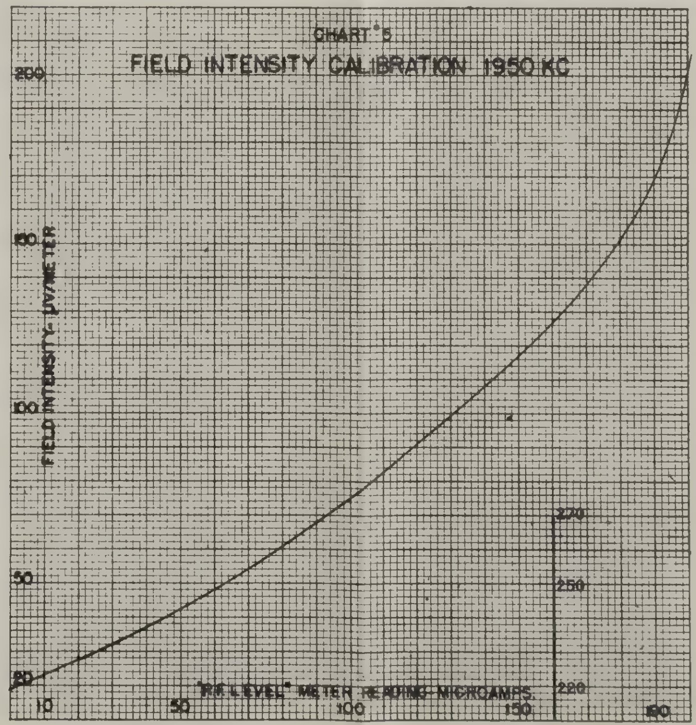
Figure 4-6. Typical Calibration Charts No. 1 through No. 5, TS-318/UP
(Not to be used for measurement purposes)











USE OF CALIBRATION CURVES AND COMPUTATIONS

1. **For Calibrated RF Frequencies** (Loran and CW Signals).

   a. From proper calibration curve, Chart #1 through #5, determine Field Intensity corresponding to **RF LEVEL** meter reading obtained in par. 2(n) and 3(h) on reverse side.

   b. Apply **Multiply By** factor to this field intensity to obtain true signal field intensity.

2. **For Uncalibrated RF Frequencies.**

   a. From Vacuum Tube Voltmeter calibration, Chart #6, obtain "Microvolts" value corresponding to **RF Level** meter reading.

   b. From Loop Antenna Factor curve, Chart #9, obtain Loop Factor (K) corresponding to the RF frequency.

   c. Substitute values in following formula to obtain field intensity:

$$\text{Field Intensity} = \mu\text{ volts/meter} = \frac{A \times B \times C}{\text{Frequency in MC.}}$$

A = Microvolts from 2a
B = **Multiply By** setting
C = Loop Factor (K) from 2b

3. For computations when using vertical antenna, see Instruction Book.

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Figure 4-6. Typical Calibration Charts No. 1 through No. 5, TS-318/UP (Not to be used for measurement purposes)

SE OF CALIBRATION CURVES AND COMPUTATIONS

For Calibrated RF Frequencies (Loran and CW Signals).

a. From proper calibration curve, Chart #1 through #5, deter-
ne Field Intensity corresponding to **RF LEVEL** meter read-
obtained in par. 2(n) and 3(h) on reverse side.

b. Apply **Multiply By** factor to this field intensity to obtain true
nal field intensity.

For Uncalibrated RF Frequencies.

a. From Vacuum Tube Voltmeter calibration, Chart #6, obtain
icrovolts" value corresponding to **RF Level** meter reading.

b. From Loop Antenna Factor curve, Chart #9, obtain Loop
ctor (K) corresponding to the RF frequency.

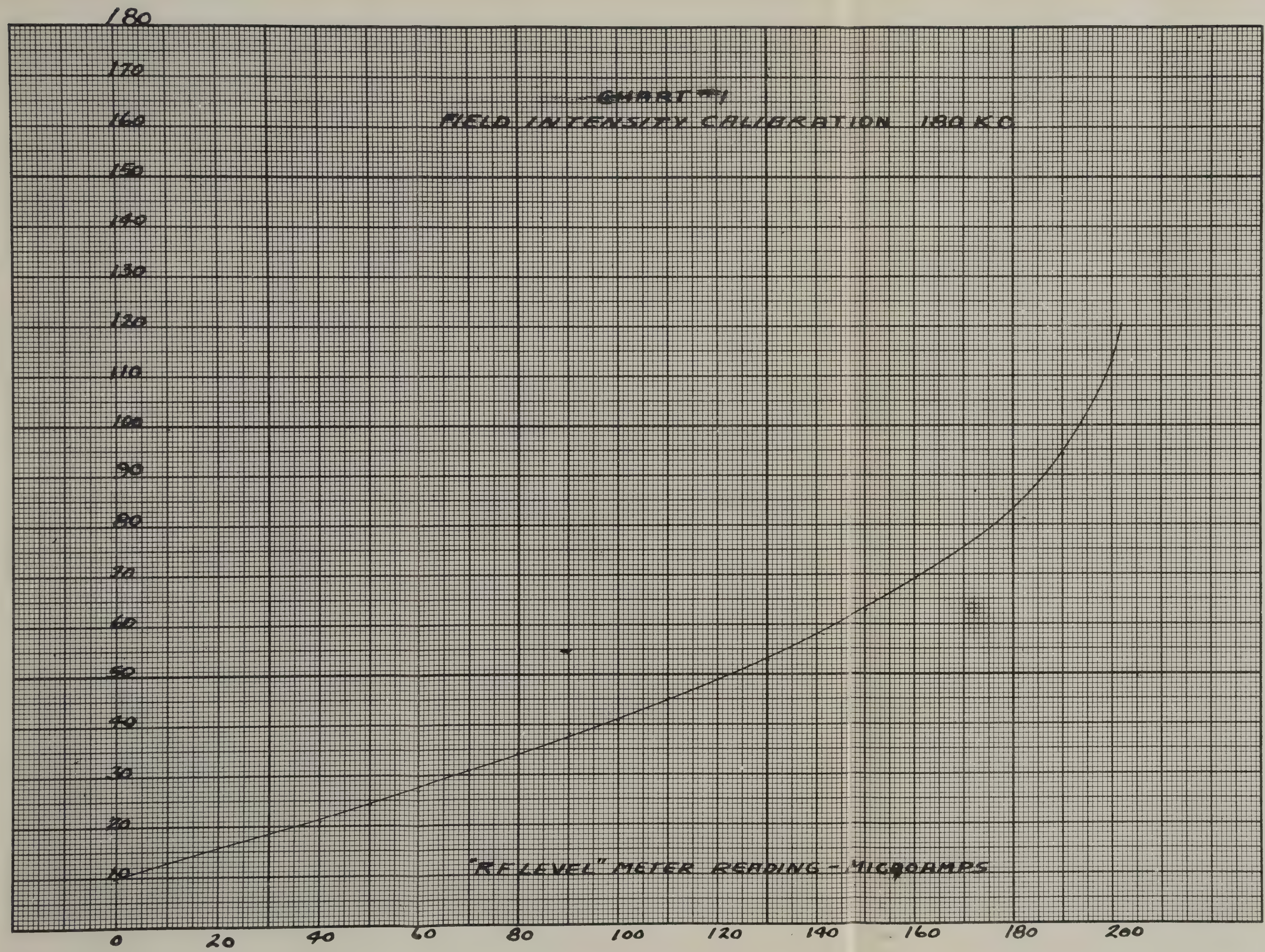
c. Substitute values in following formula to obtain field intensity:

$$\text{ld Intensity} = \mu\ \text{volts/meter} = \frac{A \times B \times C}{\text{Frequency in MC.}}$$

A = Microvolts from 2a
B = **Multiply By** setting
C = Loop Factor (K) from 2b

For computations when using vertical antenna, see Instruction Book.

Figure 4-7. Typical Calibration Chart No. 1, TS-635/UP
(Not to be used for measurement purposes)



USE OF CALIBRATION CURVES AND COMPUTATIONS

1. **For Calibrated RF Frequencies** (Loran and CW Signals).

a. From proper calibration curve, Chart #1 through #5, determine Field Intensity corresponding to **RF LEVEL** meter reading obtained in par. 2(n) and 3(h) on reverse side.

b. Apply **Multiply By** factor to this field intensity to obtain true signal field intensity.

2. **For Uncalibrated RF Frequencies.**

a. From Vacuum Tube Voltmeter calibration, Chart #6, obtain "Microvolts" value corresponding to **RF Level** meter reading.

b. From Loop Antenna Factor curve, Chart #9, obtain Loop Factor (K) corresponding to the RF frequency.

c. Substitute values in following formula to obtain field intensity:

$$\text{Field Intensity} = \mu\text{ volts/meter} = \frac{A \times B \times C}{\text{Frequency in MC.}}$$

A = Microvolts from 2a
B = **Multiply By** setting
C = Loop Factor (K) from 2b

3. For computations when using vertical antenna, see Instruction Book.

Figure 4-7. Typical Calibration Chart No. 1, TS-635/UP
(Not to be used for measurement purposes)

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:HARTS AND DATA

ATING INSTRUCTIONS

switch to "OFF". Connect Power
r with interconnecting cable.
pedestal and insert into receptacle

ost on Field Intensity Meter panel.
or switch to type of power being

Power Supply use with **115 VAC** or

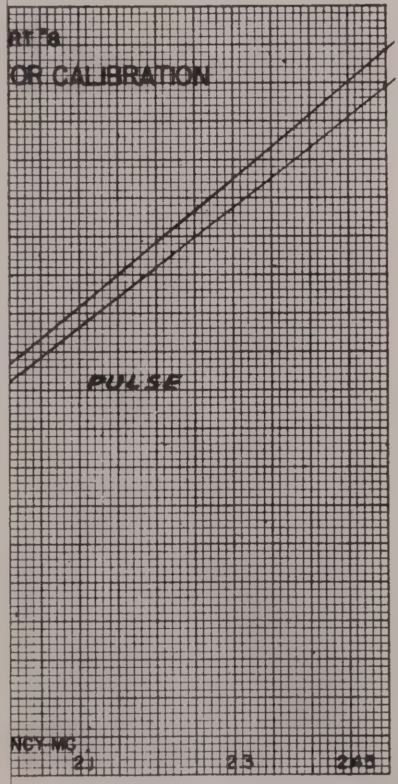
up" before measuring.
e voltage with **CW and Test** meter
ration, check plate and heater volt-
30 to 270 volts, full scale-300 volts;
c-10 volts.
itch to "OFF".
s controls for suitably bright, fine

Multiply By dial to "1".
station. See Chart #7.
c **PRR** to PRR of known station.

ontrols until pulses can be seen on

es are stationary.
equency of station to be measured.
ntrols until pulse height is approxi-

close to minimum as possible. See



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h. Adjust **Basic PRR** and **Specific PRR** until pulses are stationary. The Signal PRR is obtained from Chart Table #1 corresponding to PRR dial readings.

i. Rotate **Loop, Ant. Trim** and **Receiver Tuning** to peak signal.

j. Determine master-slave relationship. If spacing between two related pulses is greater than half the base line, the slave pulse is on the **right**. If spacing between pulses is less than half of the base line, the slave is on the **left**.

k. Tune **Generator Tuning** to signal frequency. See Chart #8.

l. Set **Selector** to "Pulse" and rotate **RF Level** control to extreme counterclockwise position. Set **RF Level** to "O" with **Zero Adj.** control.

m. Adjust **Multiply By, RF Level** and **Generator Tuning** controls until signal and generator pulses are same height.

n. Use **RF Level** and **Multiply By** readings to determine Field Intensity. See reverse side.

3. **To Measure CW Signals.**

a. Set **Meter** switch to "CW" and **Selector** switch to "OFF".

b. Adjust **Receiver Tuning** to station frequency. See Chart #7. Tune for **CW and Test** meter dip.

c. Rotate Loop Antenna and adjust **Ant. Trim.** for further dip. Adjust **RF** and **IF Gain** controls for convenient meter reading.

d. Rotate Loop Antenna for maximum reading of **CW and Test** meter.

e. Turn **Selector** to "CW" and check zero setting of **RF Level** meter as in par. 2(1).

f. Rotate **Generator Tuning** for maximum **CW and Test** meter dip at dial setting corresponding to station RF frequency. See Chart #8.

g. Adjust **RF Level** and **Multiply By** controls until **CW and Test** meter reads same as in 3(c). DO NOT CHANGE **RF** AND **IF GAIN** CONTROLS. Recheck **Generator Tuning** dip.

h. Use **RF Level** and **Multiply By** readings to compute field intensity. See reverse side.

4. **See Instruction Book for Operation with Vertical Antenna.**

CHART TABLE No. 1

"SPECIFIC PRR" DIAL READINGS

	S-Rate	L-Rate	H-Rate
0	10.0	10.0	10.0
1	15.4	17.0	20.5
2	21.5	24.6	31.5
3	28.0	32.2	41.3
4	34.5	40.3	51.0
5	41.3	47.5	61.5
6	47.3	54.5	70.5
7	53.0	61.6	82.0

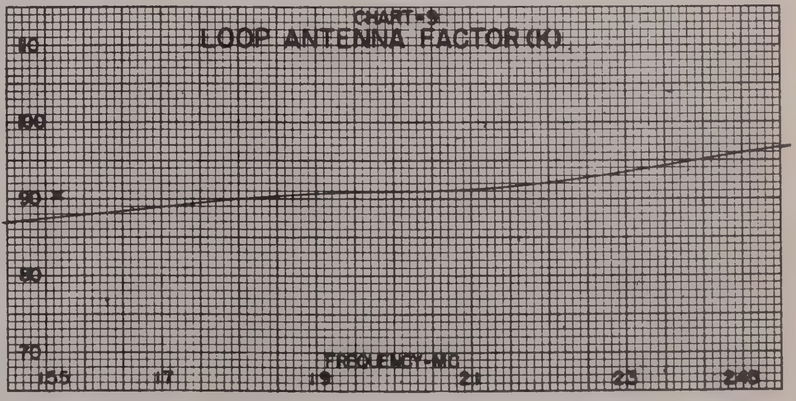

Figure 4-8. Typical Calibration Charts No. 6 through No. 9, TS-635/UP (Not to be used for measurement purposes)

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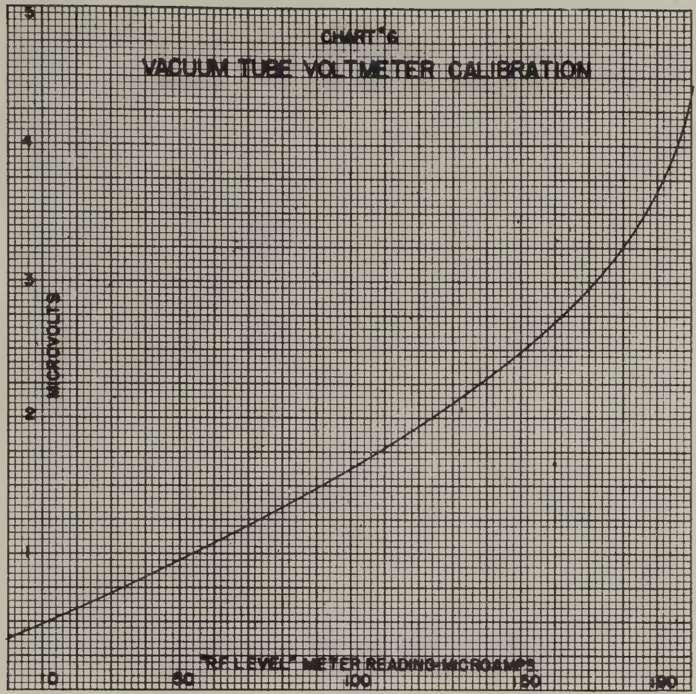
CALIBRATION CHARTS AND DATA



TS-318/UP Serial No. 27

CONDENSED OPERATING INSTRUCTIONS

1. **Preliminary**

a. Set Power Supply selector switch to "OFF". Connect Power Supply to Field Intensity Meter with interconnecting cable.

b. Fasten Loop Antenna to pedestal and insert into receptacle on top of Field Intensity Meter.

c. Attach a good ground to post on Field Intensity Meter panel.

d. Turn Power Supply selector switch to type of power being used.

Note: Cables provided for Power Supply use with **115 VAC** or **EXT. BAT.**

e. Allow 20 minutes "warm-up" before measuring.

f. On AC operation, check plate voltage with **CW and Test** meter and Meter switch. On DC operation, check plate and heater voltages. Normal readings: Plate-230 to 270 volts, full scale-300 volts; Heater-5.4 to 6.4 volts, full scale-10 volts.

g. Set **CW and Test** meter switch to "OFF".

h. Adjust **Intensity** and **Focus** controls for suitably bright, fine line on Cathode Ray Tube.

2. **To Measure Loran Signals**

a. Set **Selector** to "OFF", and **Multiply By** dial to "1".

b. Tune Receiver to a known station. See Chart #7.

c. Set **Basic PRR** and **Specific PRR** to PRR of known station. See Chart Table #1.

d. Adjust **RF** and **IF Gain** controls until pulses can be seen on CR tube.

e. Adjust **PRR Cal** until pulses are stationary.

f. Tune **Receiver Tuning** to frequency of station to be measured.

g. Adjust **RF** and **IF Gain** controls until pulse height is approximately ¼".

Note: Operate RF gain as close to minimum as possible. See Instruction Book.

h. Adjust **Basic PRR** and **Specific PRR** until pulses are stationary. The Signal PRR is obtained from Chart Table #1 corresponding to PRR dial readings.

i. Rotate **Loop, Ant. Trim** and **Receiver Tuning** to peak signal.

j. Determine master-slave relationship. If spacing between two related pulses is greater than half the base line, the slave pulse is on the **right.** If spacing between pulses is less than half of the base line, the slave is on the **left.**

k. Tune **Generator Tuning** to signal frequency. See Chart #8.

l. Set **Selector** to "Pulse" and rotate **RF Level** control to extreme counterclockwise position. Set **RF Level** to "O" with **Zero Adj.** control.

m. Adjust **Multiply By, RF Level** and **Generator Tuning** controls until signal and generator pulses are same height.

n. Use **RF Level** and **Multiply By** readings to determine Field Intensity. See reverse side.

3. **To Measure CW Signals.**

a. Set **Meter** switch to "CW" and **Selector** switch to "OFF".

b. Adjust **Receiver Tuning** to station frequency. See Chart #7. Tune for **CW and Test** meter dip.

c. Rotate Loop Antenna and adjust **Ant. Trim.** for further dip. Adjust **RF** and **IF Gain** controls for convenient meter reading.

d. Rotate Loop Antenna for maximum reading of **CW and Test** meter.

e. Turn **Selector** to "CW" and check zero setting of **RF Level** meter as in par. 2(1).

f. Rotate **Generator Tuning** for maximum **CW and Test** meter dip at dial setting corresponding to station RF frequency. See Chart #8.

g. Adjust **RF Level** and **Multiply By** controls until **CW and Test** meter reads same as in 3(c). DO NOT CHANGE **RF** AND **IF GAIN** CONTROLS. Recheck **Generator Tuning** dip.

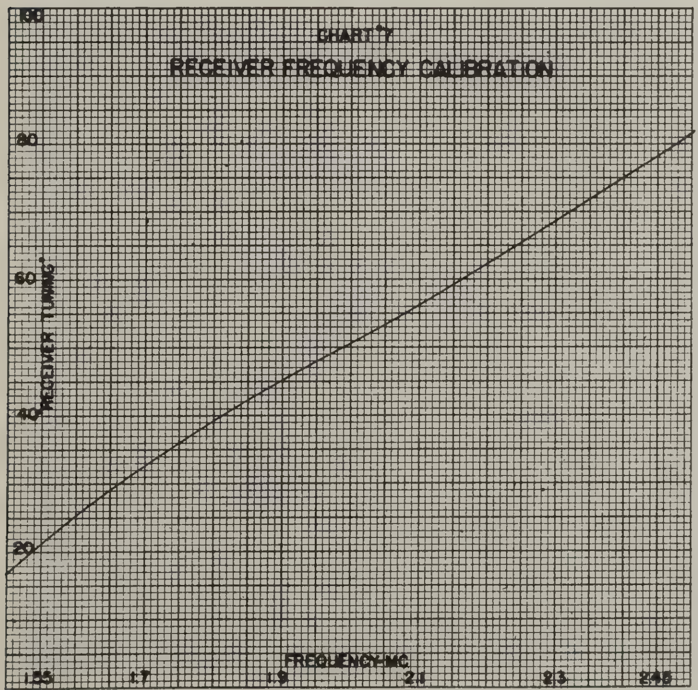
h. Use **RF Level** and **Multiply By** readings to compute field intensity. See reverse side.

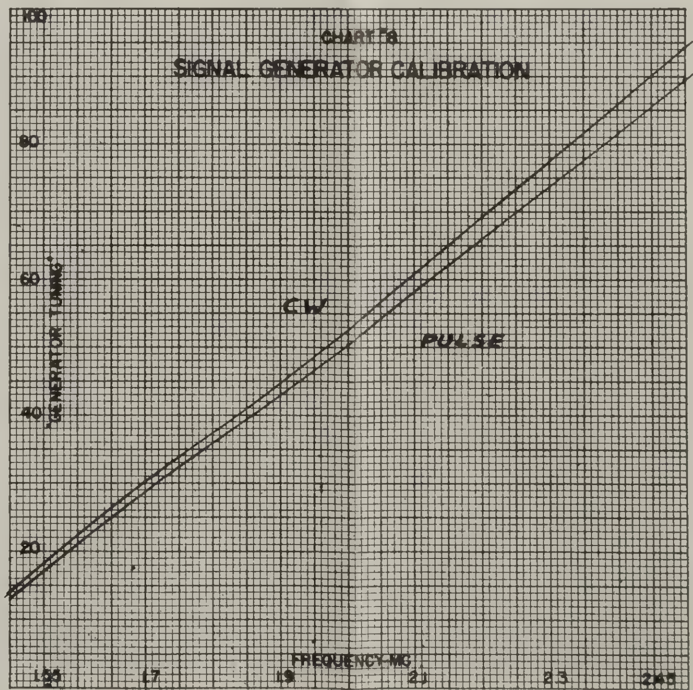
4. **See Instruction Book for Operation with Vertical Antenna.**

CHART TABLE No. 1

"SPECIFIC PRR" DIAL READINGS

	S-Rate	L-Rate	H-Rate
0	10.0	10.0	10.0
1	15.4	17.0	20.5
2	21.5	24.6	31.5
3	28.0	32.2	41.3
4	34.5	40.3	51.0
5	41.3	47.5	61.5
6	47.3	54.5	70.5
7	53.0	61.6	82.0





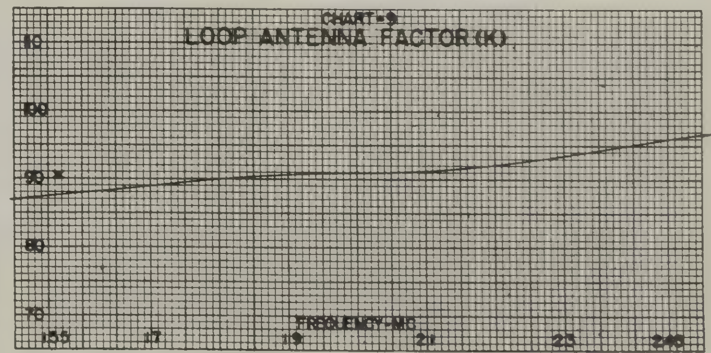


Figure 4-8. Typical Calibration Charts No. 6 through No. 9, TS-635/UP (Not to be used for measurement purposes)

SECTION 5
OPERATOR'S MAINTENANCE

1. ROUTINE CHECKS.

a. Before attaching the pedestal to the Loop Antenna, inspect the end which is inserted into the receptacle for dirt and dust accumulations. Wipe with a clean dry cloth if necessary.

b. BATTERY CHECK.

(1) Remove the cover from the Power Supply PP-287/U by unfastening the six drawbolts and lifting the cover up.

(2) Remove the three caps covering the battery cells by twisting them counterclockwise and pulling up when the turning motion is stopped.

(3) Insert a standard battery hydrometer in each cell to check the specific gravity of the electrolyte. For a fully charged battery the reading should be 1.220 at 80° F.

(4) If the battery needs recharging, it could be accomplished while the battery is mounted in the Power Supply provided the switch on the Power Supply is in the OFF or 115 VAC position. The battery charge leads may be clipped directly onto the battery terminals.

(5) If the battery needs recharging and it is more convenient to remove it from the case, unfasten the wires connected to the battery terminals.

Unscrew the holding clamps, one on each side of the battery, and lift the battery out by means of the finger holes on the ends.

(6) BATTERY DATA—NAVY TYPE 6V-SBM-50AH.

(a) DISCHARGE RATE.
5 amperes for 10 hours
120 amperes for 5 minutes

(b) LOW VOLTAGE LIMIT.—1.75 volts per cell at the 10-hour rate.

(c) CHARGING RATE.
start 8 amperes
finish 4 amperes

(d) MAXIMUM SPECIFIC GRAVITY.—1.220 at 80° F.

(e) HEIGHT OF ELECTROLYTE.—½″ over top of separators.

c. Before making measurements, the operator must set up the equipment and make the preliminary checks as specified in Sec. 4-2.

2. EMERGENCY MAINTENANCE.

Notice to Operators

Operators shall not perform any of the following emergency maintenance procedure without proper authorization.

a. REPLACEMENT OF TUBES AND FUSES.

(1) PROBABLE FUSE FAILURE. (See Table 5-1.)

WARNING

Never replace a fuse with one of higher rating unless continued operation of the equipment is more important than probable damage. If a fuse burns out immediately after replacement, do not replace it a second time until the cause has been corrected.

TABLE 5–1. SYMPTOMS OF FUSE FAILURE

OPERATION	CRT TRACE	RF LEVEL METER	HEATER METER READING	PLATE METER READING	VIBRATOR HUM	BLOWN FUSE	RATING
115 VAC	no	no	*	no	**	F-603 F-604	1A 1A
Battery (Int. and Ext.)	no	no	yes	no	no	F-601	10A
Battery (Int. and Ext.)	no	yes	no	yes	yes	F-602	10A

* A.C. Heater voltage cannot be read on *CW and Test* Meter.

** Vibrator, Y-601, is not used on AC operation. Vibrations and hum can be heard or felt when the vibrator is working.

(2) FUSE LOCATIONS.—All fuses are located on the front panel of Power Supply PP-287/U.

(3) TUBE LOCATIONS. *(See Sec. 7.)*

(4) REPLACING ELECTRON TUBES.

(a) CATHODE RAY TUBE.—This tube is the only tube which may be replaced without removing the case from the Field Intensity Meter. Unscrew the locking ring (See figure 5-1) and pull the lightshade out. Grasp the edge of the cathode ray tube and pull it from its socket. Insert a new tube being careful that the key on the base lines up with the key way in the base and push gently against the face of the tube until the tube is seated. Slide the sun shade in place after checking to see if the clamping rings, clamping gasket and locking ring are in the proper order.

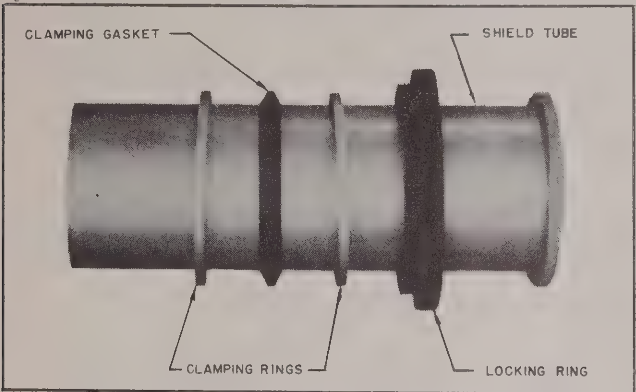


Figure 5–1. Light Shade, Disassembled

(b) All of the remaining tubes except V-401, V-402, and V-403 in the Signal Generator Unit in the Field Intensity Meter are immediately accessible after the case has been removed. The case is removed by loosening the ten screwdriver operated fasteners around the edge of the panel by turning in a counterclockwise direction and sliding the Field Intensity Meter out.

(c) After the case has been removed, access to V-402 is obtained by sliding the bottom panel on the Signal Generator Unit chassis away from the front panel. V-401 and V-403 are accessible after the side panel has been removed from the Signal Generator Unit.

WARNING

Replacement of tubes in the Field Intensity Meter may result in misalignment and loss of calibration particularly in the Signal Generator Unit. See Sec. 7 for calibration instructions.

(d) POWER SUPPLY.—The tubes and vibrator may be replaced in this unit through the open sides of the unit after the four fasteners on the edges of the panel are twisted counterclockwise and the unit is lifted up by means of the two handles on the panel.

SECTION 6
PREVENTIVE MAINTENANCE

Note

THE ATTENTION OF THE MAINTENANCE PERSONNEL IS INVITED TO THE REQUIREMENTS OF CHAPTER 67 OF THE BUREAU OF SHIPS MANUAL, OF THE LATEST ISSUE.

1. BATTERY MAINTENANCE.

The Navy Type 6V-SBM-50AH storage battery used with Field Intensity Meters TS-318/UP and TS-635/UP must be put on charge at least once per month even though it is not in use. The water level in the battery cells, the charging rates and maximum specific gravity should be in accordance with Sec. 5-1*b*(6).

FAILURE REPORTS

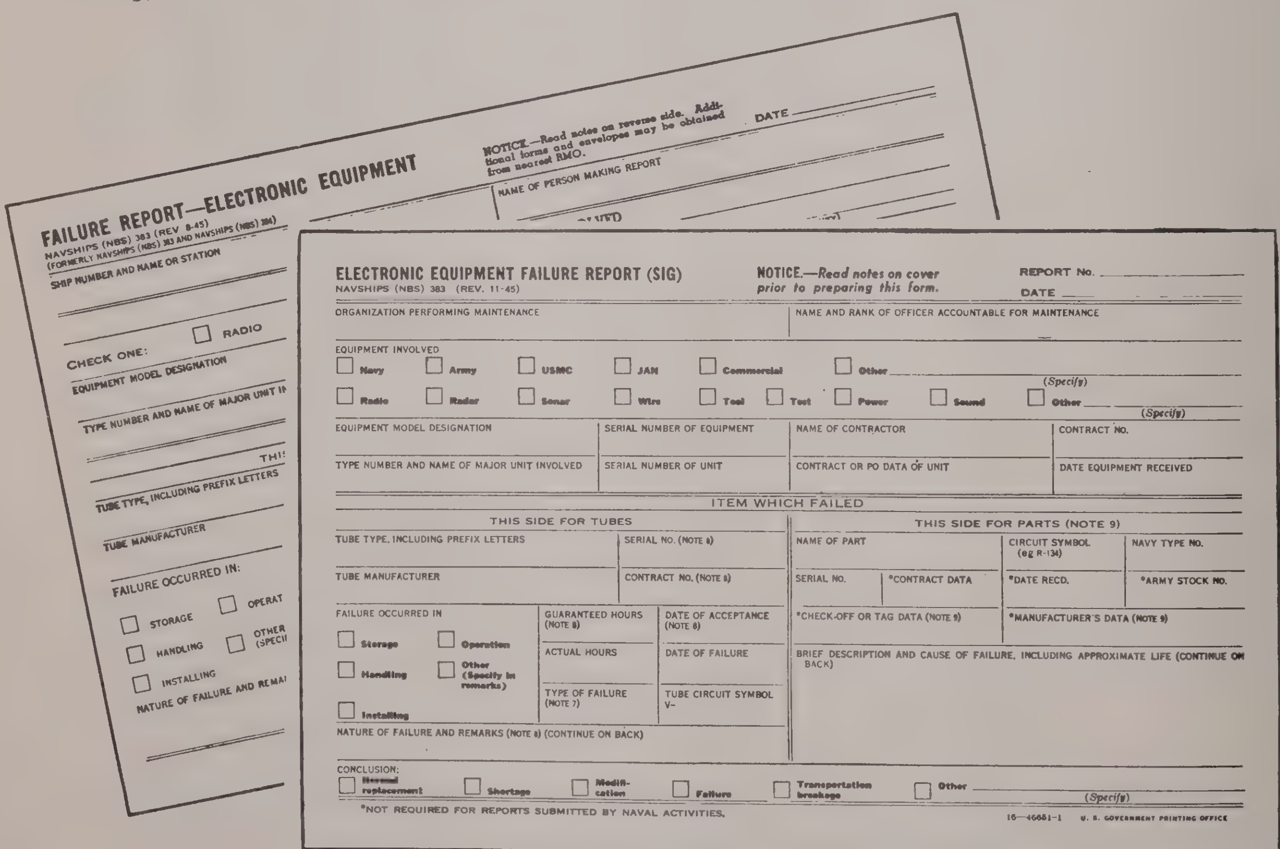
A FAILURE REPORT must be filled out for the failure of any part of the equipment whether caused by defective or worn parts, improper operation, or external influences. It should be made on Failure Report, form NBS-383, which has been designed to simplify this requirement. The card must be filled out and forwarded to BUSHIPS in the franked envelope which is provided. Full instructions are to be found on each card.

Use great care in filling the card out to make certain it carries adequate information. For example, under "Circuit Symbol" use the proper circuit identification taken from the schematic drawings, such as T-803, in the case of a transformer, or R-207, for a resistor. Do not substitute brevity for clarity. Use the back of the card to completely describe the cause of failure and attach an extra piece of paper if necessary.

The purpose of this report is to inform BUSHIPS of the cause and rate of failures. The information is used by the Bureau in the design of future equipment and the maintenance of adequate supplies to keep the present equipment going. The cards you send in, together with those from hundreds of other ships, furnish a store of information permitting the Bureau to keep in touch with the performance of the equipment of your ship and all other ships of the Navy.

This report is not a requisition. You must request the replacement of parts through your Officer-in-Charge in the usual manner.

Make certain you have a supply of Failure Report cards and envelopes on board. They may be obtained from the nearest District Publication and Printing Office.


FAILURE REPORT—ELECTRONIC EQUIPMENT
NAVSHIPS (NBS) 383 (REV 8-45)
(FORMERLY NAVSHIPS (NBS) 383 AND NAVSHIPS (NBS) 384)
NOTICE.—Read notes on reverse side. Additional forms and envelopes may be obtained from nearest RMO.
DATE
NAME OF PERSON MAKING REPORT
SHIP NUMBER AND NAME OR STATION
CHECK ONE: RADIO
EQUIPMENT MODEL DESIGNATION
TYPE NUMBER AND NAME OF MAJOR UNIT
TUBE TYPE, INCLUDING PREFIX LETTERS
TUBE MANUFACTURER
FAILURE OCCURRED IN: STORAGE / OPERAT / HANDLING / OTHER (SPECI / INSTALLING
NATURE OF FAILURE AND REMA

ELECTRONIC EQUIPMENT FAILURE REPORT (SIG)
NAVSHIPS (NBS) 383 (REV. 11-45)
NOTICE.—Read notes on cover prior to preparing this form.
REPORT No.
DATE
ORGANIZATION PERFORMING MAINTENANCE
NAME AND RANK OF OFFICER ACCOUNTABLE FOR MAINTENANCE
EQUIPMENT INVOLVED
Navy / Army / USMC / JAN / Commercial / Other (Specify)
Radio / Radar / Sonar / Wire / Tool / Test / Power / Sound / Other (Specify)
EQUIPMENT MODEL DESIGNATION | SERIAL NUMBER OF EQUIPMENT | NAME OF CONTRACTOR | CONTRACT NO.
TYPE NUMBER AND NAME OF MAJOR UNIT INVOLVED | SERIAL NUMBER OF UNIT | CONTRACT OR PO DATA OF UNIT | DATE EQUIPMENT RECEIVED
ITEM WHICH FAILED
THIS SIDE FOR TUBES
TUBE TYPE, INCLUDING PREFIX LETTERS | SERIAL NO. (NOTE 8)
TUBE MANUFACTURER | CONTRACT NO. (NOTE 8)
FAILURE OCCURRED IN: Storage / Operation / Handling / Other (Specify in remarks) / Installing
GUARANTEED HOURS (NOTE 8) | DATE OF ACCEPTANCE (NOTE 8)
ACTUAL HOURS | DATE OF FAILURE
TYPE OF FAILURE (NOTE 7) | TUBE CIRCUIT SYMBOL V–
NATURE OF FAILURE AND REMARKS (NOTE 8) (CONTINUE ON BACK)
THIS SIDE FOR PARTS (NOTE 9)
NAME OF PART | CIRCUIT SYMBOL (eg R-134) | NAVY TYPE NO.
SERIAL NO. | *CONTRACT DATA | *DATE RECD. | *ARMY STOCK NO.
*CHECK-OFF OR TAG DATA (NOTE 9) | *MANUFACTURER'S DATA (NOTE 9)
BRIEF DESCRIPTION AND CAUSE OF FAILURE, INCLUDING APPROXIMATE LIFE (CONTINUE ON BACK)
CONCLUSION: Normal replacement / Shortage / Modification / Failure / Transportation breakage / Other (Specify)
*NOT REQUIRED FOR REPORTS SUBMITTED BY NAVAL ACTIVITIES.
16—46681-1 U. S. GOVERNMENT PRINTING OFFICE

Figure 7-1. Failure Report, Sample Form

SECTION 7
CORRECTIVE MAINTENANCE

1. THEORY OF LOCALIZATION.

a. Efficient trouble shooting consists of following a systematic procedure in which the trouble or fault is localized in a subassembly such as the receiver, signal generator, etc., thence to a smaller assembly such as the RF oscillator in the Signal Generator and finally to a particular component.

2. TEST EQUIPMENT.

a. Table 7-1 lists test equipment which may be used for servicing of Field Intensity Meter Equipments TS-318/UP and TS-635/UP.

(c) Receiver *RF Gain* (R-302) at maximum (full clockwise).

(d) Receiver *IF Gain* (R-317) clockwise to maximum sensitivity setting (i.e., just above noise level as indicated on C.R. Ind. and *CW and Test* meter).

(e) *Meter* switch (S-501) on CW.

(f) *Intensity* control (R-216) at maximum CCW.

(g) *Focus* control (R-213) at maximum CCW.

TABLE 7–1. TEST EQUIPMENT

FUNCTION	NAVY MODEL NO.	ARMY MODEL NO.	A/N MODEL
Signal Generator	LP Series		
Oscilloscope	OBT Series		TS-239/UP Series TS-34/AP Series
Vacuum Tube Testing Equipment	OZ Series	1-177 Series	
Vacuum Tube Voltmeter	OBQ Series		
Volt-Ohm-Milliammeter	OCR Series OE Series		TS-352/U Series
Frequency Meter	LM Series	SCR-211 Series	

3. SYSTEM TROUBLE SHOOTING.

a. Faulty operation of Field Intensity Meters TS-318/UP and TS-635/UP is indicated in the interpretation of data taken from the cathode ray tube indicator trace, the *RF Level* meter response and the *CW and Test* meter readings as described in Table 7-2.

b. RESISTANCE AND VOLTAGE MEASUREMENTS.

(1) The voltage measurement tables were compiled with the Field Intensity Meter operating as follows:

(a) On a. c. operation, the line voltage adjusted to 115 VAC.

(b) On d. c. operation, a fully charged battery must be used.

(h) Horizontal and vertical centering controls at maximum CCW position.

(i) *Basic PRR* (S-101) on "S" position.

(j) *Spec. PRR* (R-107) fully CCW.

(k) *PRR Cal.* (R-108) mid-position (on marker).

(l) *Zero Adj.* (R-503) adjusted to zero *RF Level* meter.

(m) *RF Level* control (R-417A, R-417B) fully CCW.

(n) *Multiply By* control on "1."

(o) *Receiver Tuning* at zero (no signal in).

(p) *Generator Tuning* at zero (no signal out).

(q) *CW Adj.* (R-410) as is (setting as made at time of calibration).

(r) Full Scale Adj. (R-413) as is (setting as made at time of calibration).

(2) Resistance measurements were made with the controls set the same as for voltage measurements except all interconnecting cables were removed, *Selector* set to "CW" and both of the meters shunted by bus wire or equivalent.

(3) RESISTANCE AND VOLTAGE DATA.—Data in Tables 7-3 through 7-10 is approximate and maintenance personnel are cautioned to expect some deviations from these values.

TABLE 7–2. CHECK LIST FOR TROUBLE-SHOOTING

EVIDENCE OF TROUBLE	PROBABLE CAUSE	SUGGESTED CORRECTIONS
1. Does not operate: a. No spot or trace on scope. b. No RF level indication. (Control in clockwise position)	No primary voltage. Power Supply failure.	Check line voltage, cable, fuses. Try 115 VAC operation. If O.K., check "Bat." fuses and vibrator. If "Bat." operation O.K., check AC fuses and transformer primaries. Check connectors, continuity,
2. R.F. Level meter operates. No trace or spot on scope. Note: If CRI has been subjected to excessive moisture, it may take one or two hours to dry. During this time, there may be no spot or trace.	Cathode ray tube bad. Vertical and horizontal positioning adjustment out. H.V. failure. Resistor leakage.	Replace tube. Readjust. (Be sure set is dried out.) Check 8016 rectifier. Check resistance H.V. to ground.
3. Horizontal deflection on scope. R.F. Level reads backward. (Control counterclockwise.)	CW Oscillator not functioning. Oscillator RF not reaching VTVM.	Check oscillator tube. Check oscillator plate voltage. Check VTVM diode.
4. Horizontal deflection on scope. R.F. Level does not operate.	VTVM bridge circuit not working.	Check 150 V. supply line. Check VR tubes in power supply and signal genertor. Check DC path through VTVM.
5. Vertical deflection from Signal Generator on scope. No horizontal deflection.	Sync. Osc. and Sweep Osc. voltages not reaching scope.	Check tubes in Sync. Osc. and Sweep Osc. Check "Horiz." connections to CRI.
6. Horizontal deflection on scope. R.F. Level Indication O.K. No receiver noise on scope with gains wide open. No vertical pulses. No meter dip in *CW* and *Test* position.	Receiver not operating.	Check tubes. Check receiver voltages.
7. Receiver "noise" present on scope. CW dip on CW and Test. No vertical pulses. (Pedestal and Loop must be in place.)	Pulse generator not operating. Pulses do trigger RF oscillator. Short in antenna receptacle.	Check tube. Check bias and plate voltages on V-401 and V-402.
8. Receiver "noise" present on scope. No vertical pulses. No CW dip on CW and Test position. R.F. level indicates signal from Signal Generator.	Short in receiver antenna receptacle or coaxial line from attenuator. Receiver R.F. amp. V-301 defective. Oscillator-mixer V-302 defective.	Examine ant. and receptacle. Locate break by tracing signal from Signal Generator through attenuator to receiver.

(*a*) MEASUREMENT TABLES, TS-318/UP.

TABLE 7–3. SWEEP GENERATOR, FIELD INTENSITY METER IM–10/UP OR IM–14/UP

TUBE OR BOARD SYM. NO.	TUBE FUNCTION	TERMINAL NO. AND DESCRIPTION	6 V BATTERY OPERATION						115 VAC OPERATION						RESISTANCE TO GROUND OHMS
			VTVM		1000 OHM PER VOLT		20 K OHM PER VOLT		VTVM		1000 OHM PER VOLT		20 K OHM PER VOLT		
			VOLTS	SCALE	VOLTS	SCALE	VOLTS	SCALE	VOLTS	SCLAE	VOLTS	SCALE	VOLTS	SCALE	
V-101	200 Cycle Osc.	1 control grid	−1.9	3					−2.05	3					4.7M
		2 cathode			1.5	5	1.8	5			1.3	5	1.5	5	1500
		3 heater			0		0				0				0
		4 heater			5.7	25	5.7	25			6.3AC	25			0
		5 plate			62	100	94.5	100			87	100	109	250	150K
		6 screen grid			62	100	94	100			82	100	102	250	132K
		7 sup. grid	−1.65	3					−1.8	3					5.2M
V-102	Sweep Osc.	1 control grid	0	3					0.0						3500
		2 cathode			1.0	5	1.25	5			1.1	5	1.5	5	2200
		3 heater			0		0				0				0
		4 heater			5.7	25	5.7	25			6.3AC	25			0
		5 plate	92	100			57.0	100	92	100			57	100	2M
		6 screen grid			16.8	25	47.0	100			35	100	40	100	240K
		7 sup. grid	−14.0	30					14.0	30					6.5M
V-103	Sweep Amp.	1 NC													
		2 NC													
		3 heater			0		0								0
		4 heater			5.7	25	5.7	25			6.3AC	25			0
		5 plate			145	250	160	250			150	250	170	250	75K
		6 control grid	0				0		0						4.8M
		7 cathode			4.35	5	5.3	25			5.0	25	5.5	25	2800
V-104	Sweep Amp.	1 plate			44.0	100	121	250			52	250	129	250	500K
		2 NC													
		3 heater			0		0				0				0
		4 heater			5.7	25	5.7	25			6.3AC	25			0
		5 NC													
		6 control grid	0		0		0				0		0		0
		7 cathode			4.4	5	5.4	25			5.0	25	5.5	25	2800
E-101	Terminal Board	J	0												3500
		S	0												3500
		X-1			146	250	151	250			150	250	177	250	75K
		X-2			44	100	122	250			80	250	129	250	500K
		250 V			246	250	252	1000			257	1000	261	1000	25K
		GND			0		0				0				0
		A			5.7	25	5.7	25			6.3AC	25			0
		150 V			147	250	149	250			149	250	152	250	70K

Test Conditions: Voltage Measurements, See Sec. 7-3b(1). Resistance Measurements, See Sec. 7-3b(2).

TABLE 7–4. RECEIVER, FIELD INTENSITY METER IM–10/UP

TUBE OR BOARD SYM. NO.	TUBE FUNCTION	TERMINAL NO. AND DESCRIPTION	6 V BATTERY OPERATION						115 VAC OPERATION						RESISTANCE TO GROUND OHMS
			VTVM		1000 OHM PER VOLT		20 K OHM PER VOLT		VTVM		1000 OHM PER VOLT		20 K OHM PER VOLT		
			VOLTS	SCALE	VOLTS	SCALE	VOLTS	SCALE	VOLTS	SCALE	VOLTS	SCALE	VOLTS	SCALE	
V-301	R.F. Amp.	1 control grid			0		0								135K
		2 cathode			4.1	5	4.45	5			2.4	5	2.5	5	1100
		3 heater			5.7	25	5.7	25			6.3AC	25			0
		4 heater			0		0								0
		5 plate			192	250	197	250			178	250	187	250	28K
		6 screen grid			132	250	149	250			104	250	117	250	60K
		7 cathode, G3			4.1	5	4.45	5			2.4	5	2.5	5	1100
V-302	Osc.-Mixer	1 sup. grid			0		0								0
		2 heater			0		0								0
		3 mixer plate			240	250	243	250			250	250	255	250	27K
		4 screen grid			99	100	106	250			100	250	102	250	21K
		5 osc. grid	7.8	10					8.7	10					25K
		6 cathode			0		0								0
		7 heater			5.7	25	5.7	25			6.3AC	25			0
		8 signal grid													0
V-303	1st I.F. Amp.	1 control grid													25
		2 cathode, G3			23.5	25	25	25			16	25	16.5	25	2700
		3 heater			5.7	25	5.7	25			6.3AC	25			0
		4 heater			0		0								0
		5 plate			243	250	245	250			253	1000	258	1000	27K
		6 screen grid			145	250	159	250			136	250	150	250	50K
		7 R.F. cathode			23.5	25	25.0	25			16	25	16.5	25	2700
V-304	2nd I.F. Amp.	1 control grid													25
		2 cathode, G3			23.3	25	25.0	25			16	25	16.5	25	2700
		3 heater			5.7	25	5.7	25			6.3AC	25			0
		4 heater			0		0								0
		5 plate			243	250	246	250			253	1000	258	1000	27K
		6 screen grid			147	250	161	250			138	250	153	250	50K
		7 R.F. cathode			23.3	25	24.8	25			16	25	16.5	25	2700
V-305	3rd I.F. Amp.	1 control grid													25
		2 cathode, G3			23.6	25	25.0	25			16	25	16.5	25	2700
		3 heater			5.7	25	5.7	25			6.3AC				0
		4 heater			0		0								0
		5 plate			242	250	244	250			250	1000	255	1000	27K
		6 screen grid			144	250	158	250			134		148		50K
		7 R.F. cathode			23.6	25	25.0	25			16	25	16.5	25	2700
V-306	Det. Vid. Amp.	1 control grid									0.6	5	72	100	135K
		2 cathode			56.0	100	88.2	100			80	100	95	100	100K
		3 heater			5.7	25	5.7	25			6.3AC				0
		4 heater			0		0								0
		5 diode plate					74.2	100			0.8	5	80	100	127K
		6 diode plate					74.2	100			0.8	5	80	100	127K
		7 triode plate			125	250	153.0	250			130	250	160	250	125K

Test Conditions: Voltage Measurement, See Sec. 7-3b(1). Resistance Measurements, See Sec. 7-3b(2).

TABLE 7–5. "PULSE" OPERATION, SIGNAL GENERATOR, FIELD INTENSITY METER IM–10/UP

TUBE OR BOARD SYM. NO.	TUBE FUNCTION	TERMINAL NO. AND DESCRIPTION	S-401 ON "PULSE"												RESISTANCE TO GROUND OHMS
			6 V BATTERY OPERATION						115 VAC OPERATION						
			VTVM		1000 OHM PER VOLT		20 K OHM PER VOLT		VTVM		1000 OHM PER VOLT		20 K OHM PER VOLT		
			VOLTS	SCALE	VOLTS	SCALE	VOLTS	SCALE	VOLTS	SCALE	VOLTS	SCALE	VOLTS	SCALE	
V-401	Pulse Generator	1 control grid	0												62K
		2 cathode			1.10	5	1.23	5			2.5	5	3	5	15K
		3 heater			5.7	25	5.7	25			6.3VAC	25			0
		4 heater			0		0								0
		5 plate			111	250	145	250			112	250	147	250	150K
		6 screen grid			42	100	55	100			42	100	55	100	170K
		7 sup. grid	−9.1	10					−9.5	10	−1.25	25	−8.5	25	5.6M
V-402	R.F. Osc.	1 control grid	0		0		0		0		0		0		23K
		2 cathode			7.4	25	9.1	25			6.5	25	8.5	25	24K
		3 heater			5.7	25	5.7	25			6.3VAC	25			0
		4 heater			0		0								0
		5 plate			135	250	155	250			138	250	257	250	6K
		6 screen grid			135	250	155	250			138	250	157	250	6K
		7 cathode, G3			7.4	25	9.1	25			6.5	25	8.5	25	2400
V-403	VTVM Rectifier	1 cathode			8.8	25	16	25			9	25	16	25	42K
		2 plate			7.0	25	82	25			7	25	8	25	4200
		3 heater			5.7	11	5.7	25			6.3VAC	25			0
		4 heater			0		0								
		5 cathode			8.8	25	16	25			9	25	16	25	42K
		6 NC													
		7 plate			7.0	25	8.2	25			7	25	8	25	4200
V-404	Voltage Reg.	1 NC													
		2 cathode			148	250	148	250			148	250	148	250	70K
		3 jumper			232	250	233	250			235	250	237	250	24K
		4 NC													
		5 plate			222	250	233	250			224	250	231	250	24K
		6 NC													
		7 jumper			232	250	233	250			235	250	237	250	24K
		8 NC													
E-401	Terminal Board	A+									6.3VAC	25			0.3
		M−													4000
		M+													4000
		150 V.			148	250	148	250			148	250	148	250	70K
	Ext. VTVM Jack	J-401-A							0.11AC	1.5					190
		J-401-B													0
E-402	Terminal Board	"O"ADJ (top)			148	250	150	250			152	250	152	250	40K
		SYNC							0		0		0		3500
		250 V.			246	250	252	1000			257	1000	261	1000	24K
		"O"ADJ.			222	250	233	250			217		232	250	25K

Test Conditions: Voltage Measurements, See Sec. 7-3b(1). Resistance Measurements, See Sec. 7-3b(2).

TABLE 7–6. "CW" OPERATION, SIGNAL GENERATOR, FIELD INTENSITY METER IM–10/UP

TUBE OR BOARD SYM. NO.	TUBE FUNCTION	TERMINAL NO. AND DESCRIPTION	S-401 ON "C.W."												
			6 V BATTERY OPERATION						115 VAC OPERATION						
			VTVM		1000 OHM PER VOLT		20 K OHM PER VOLT		VTVM		1000 OHM PER VOLT		20 K OHM PER VOLT		RESISTANCE TO GROUND OHMS
			VOLTS	SCALE	VOLTS	SCALE	VOLTS	SCALE	VOLTS	SCALE	VOLTS	SCALE	VOLTS	SCALE	
V-401	Pulse Generator	1 control grid	0						0						60K
		2 cathode			1.22	5	1.45	5			2.6	5	3	5	1500
		3 heater			5.7	25	5.7	25			6.3AC	25			0
		4 heater			0		0				0		0		0
		5 plate			111	250	145	250			112	250	148	250	150K
		6 screen grid			42	100	55	100			41	100	54	100	170K
		7 sup. grid	−9.2	10					−9.1	10					5.6M
V-402	R.F. Oscillator	1 control grid	−8.6	10					−8.5	10					24.2K
		2 cathode			0		0				0		0		24K
		3 heater			5.7	25	5.7	25			6.3AC	25			0
		4 heater			0		0								0
		5 plate			102	250	109	250			103	250	109.5	250	620K
		6 screen grid			102	250	109	250			103	250	109.5	250	620K
		7 cathode, G3			0		0				0		0		24K
V-403	VTVM Rectifier	1 cathode			13.5	25	16.6	25			13.5	25	16.5	25	40K
		2 plate			4.45	5	8.1	25			7	25	8.5	25	4200
		3 heater			5.7	25	5.7	25			6.3AC				0
		4 heater			0		0								0
		5 cathode			13.5	25	16.6	25			13.5	25	16.5	25	40K
		6 NC													
		7 plate			4.45	5	8.1	25			7	25	8.5	25	4200
V-404	Voltage Reg.	1 NC													
		2 cathode			147	250	148	250			148	250	148	250	70K
		3 jumper			232	250	225	250			236	250	230	250	30K
		4 NC													
		5 plate			222		223	250			223	250	223	250	30K
		6 NC													
		7 jumper			232	250	233	250			236	250	238	250	30K
		8 NC													
E-401	Terminal Board	A			5.7	25	5.7	25			6.3AC				0.3
		M−													4K
		M+													4K
		150			148	250	148	250			150	250	150	250	70K
	Ext. VTVM Jack	J-401-A							0.4AC	1.5					190
		J-401-B													0
E-402	Terminal Board	"O"ADJ (top)			117	250	124	250			119	250	125	250	40K
		Sync.			0		0				0				3500
		250 V.			246		252	1000			257	1000	261	1000	24K
		"O"ADJ (lower)			222	250	223	250			223	250	225	250	25K

Test Conditions: Voltage Measurements, See Sec. 7-3b(1). Resistance Measurements, See Sec. 7-3b(2).

TABLE 7–7. POWER SUPPLY, PP–287/U

TUBE OR BOARD SYM. NO.	TUBE FUNCTION	TERMINAL NO. AND DESCRIPTION	S-601 ON EXTERNAL BATTERY			S-601 ON 115 VAC						
			6 V BATTERY OPERATION			115 VAC OPERATION						
			VTVM	1000 OHMS PER VOLT	20 K OHMS PER VOLT	VTVM		1000 OHMS PER VOLT		20 K OHMS PER VOLT		RESISTANCE TO GROUND
						VOLTS	SCALE	VOLTS	SCALE	VOLTS	SCALE	
Y-601	Vibrator	1										0
		2										20
	(DC to AC)	3										500M
		4 NC										
V-601	High Voltage Rectifier 8016	1 NC										
		2 to 7 heater*	1.3 VAC*	1.28 VAC*		1.2AC	3					10M
		3 NC	*WARNING:	Terminals 2 and	7 are 1000 V							
		4 NC	above ground.	Remove plate ca	p from V-601							
		5 NC	before measur	ement.								
		6 NC										
		7 to 2 heater*	1.3 VAC*	1.28 VAC*		1.2AC	3					10M
		8 NC										
		Plate cap										
V-602	Low Voltage Rectifier 6X5	1 NC										
		2 heater						6.4AC	25			Infin.
		3 plate	270 VAC	262 VAC				260VAC	1000			175
		4 NC										
		5 plate	270 VAC	262 VAC				260VAC	1000			185
		6 NC										
		7 heater		5.7DC 25	5.7DC 25							Infin.
		8 cathode		250 250	257 1000			265	1000	267	1000	200K
V-603	Voltage Reg.	1 NC										
		2 cathode										0
		3 jumper		245 250	252 1000			260	1000	267	1000	200K
		4 NC										
		5 plate		142	147 250			146	250	154	250	Infin.
		6 NC										
		7 jumper		245 250	253 1000			260	1000	267	1000	200K
		8 NC										
J-602	Power Output	A										0
		B	Read all voltag	es at terminal bo	ard, E-501, on							Infin.
		C	back of front	panel.								Infin.
		D										9.5M
		E										200K
		F										Infin.
J-601	Power Input (S-601 to "OFF")	Either Contact										Infin.

Test Conditions: Voltage Measurements, See Sec. 7-3b(1). Resistance Measurements, See Sec. 7-3b(2).

TABLE 7–8. TERMINAL BOARDS, FIELD INTENSITY METER, IM–10/UP OR IM–14/UP

TUBE OR BOARD SYM. NO.	TERMINAL DESCRIPTION	6 V BATTERY OPERATION				115 VAC OPERATION				RESISTANCE (ohms)
		1000 OHMS PER VOLT		20 K OHMS PER VOLT		1000 OHMS PER VOLT		20 K OHMS PER VOLT		
		VOLTS	SCALE	VOLTS	SCALE	VOLTS	SCALE	VOLTS	SCALE	
E-201 Cathode Ray Tube Indicator	X1	146	250	151	250	150	250	170	250	75K
	X2	44	100	122	250	80	100	125	250	500K
	1000 V			740	5000			850	5000	2.2 meg.
	A	5.7	25	5.7	25	6.3VAC	25			0
	GND	0		0		0				0
	Y1	46	100	87	100	78	100	93	100	100K
	Y2	147	250	149	250	130	250	150	250	130K
E-301 Receiver	250	246	1000	252	1000	257		261		28K
	GND	0		0		0		0		0
	A	5.7	25	5.7	25	6.3VAC				0
E-501 On back of FIM front panel	A–	0		0		0				0
	1000 V	875	1000	900	1000			1140	5000	2.2
	A+	5.7	25	5.7	25	6.3VAC				0
	250 V	238	250	243	250	257	1000	261	1000	28K
	GND	0		0						0
	150 V	143	250	148	250	147	250	148	250	70K

Test Conditions: Voltage Measurements, See Sec. 7-3b(1). Resistance Measurements, See Sec. 7-3b(2).

TABLE 7–9. RECEIVER, FIELD INTENSITY METER IM–14/UP

TUBE OR BOARD SYM. NO.	TUBE FUNCTION	TERMINAL NO. AND DESCRIPTION	115 VAC OPERATION						
			VTVM		1000 OHM PER VOLT		20 K OHM PER VOLT		RESISTANCE TO GROUND OHMS
			VOLTS	SCALE	VOLTS	SCALE	VOLTS	SCALE	
V-301	R.F. Amplifier	1 control grid	0		0		0		0
		2 cathode	−2.4	10					1100
		3 heater			6.5AC				0
		4 heater			0				0
		5 plate			54	100	68	100	45K
		6 screen grid			100	250	105.	250	60K
		7 cathode, G-3	−2.4	10	2.3	5	2.4	5	1100
V-302	Osc. Mixer	1 sup. grid	0		0		0		0
		2 heater			0		0		0
		3 mixer plate			250	250	245	250	2700
		4 screen grid			93	100	96	100	21K
		5 osc. grid	−1.8	3					18K
		6 cathode			0		0		0
		7 heater			6.5AC				0
		8 sig. grid	0		0		0		0
V-303) V-304) V-305) V-306)	Same as Table 7-4.								

Test Conditions: Voltage Measurements, See Sec. 7-3b(1). Resistance Measurements, See Sec. 7-3b(2).

TABLE 7–10. SIGNAL GENERATOR, FIELD INTENSITY METER IM–14/UP

TUBE OR BOARD SYM. NO.	TUBE FUNCTION	TERMINAL NO. AND DESCRIPTION	115 VAC OPERATION													
			SELECTOR ON "PULSE"							SELECTOR ON "CW"						
			VTVM		1000 OHM PER VOLT		20 K OHM PER VOLT		RESISTANCE TO GROUND OHMS	VTVM		1000 OHM PER VOLT		20 K OHM PER VOLT		RESISTANCE TO GROUND OHMS
			Volts	Scale	Volts	Scale	Volts	Scale		Volts	Scale	Volts	Scale	Volts	Scale	
V-401	Pulse Generator	1 control grid	+2.45	0	3		0		65 K	+2.5	3					64 K
		2 cathode			1.6	5	1.7	5	800	1.7	3					800
		3 heater			6.5AC				0			6.5AC				0
		4 heater			0		0		0			0		0		0
		5 plate			142	250	146	250	74 K			152	250	149	250	74 K
		6 screen grid			59	100	75	100	110 K			60	100	76	100	110 K
S-403 position	50 microsecs.	7 sup. grid	13.5	30					3.9 M	−11.0	30					3.9 M
	100 microsecs.	7 sup. grid	12.0	30					1.8 M							
	200 microsecs.	7 sup. grid	13.5	30					.82 M							
	300 microsecs.	7 sup. grid	12.0	30					.51 M							
V-402	R.F. Osc.	1 control grid	0		0		0		32 K	6.8	10					32 K
		2 cathode	10.6	30	8	25	10.2	25	2400	0		0		0		0
		3 heater			0		0		0			6.5AC	25			0
		4 heater			6.5AC	25			0			0		0		0
		5 plate			155	250	169	250	45 K			142	250	145	250	45 K
		6 screen grid			155	250	169	250	45 K			142	250	145	250	45 K
		7 cathode, G3	10.6	30	8	25	10.2	25	2400	0		0		0		0
V-403 V-404 E-401 E-402	Same as Table 7-5 and	7-6, 115 V. operation														

Test Conditions: Voltage Measurements, See Sec. 7-3b(1). Resistance Measurements, See Sec. 7-3b(2).

(*b*) MEASUREMENT TABLES, TS-635/UP.—The voltage and resistance measurements on this equipment are the same as for TS-318/UP (See Tables 7-3 through 7-8) except for the Receiver Unit and Signal Generator Unit values given in Tables 7-9 and 7-10.

4. UNIT ADJUSTMENT AND TROUBLE SHOOTING.

a. ELECTRICAL ADJUSTMENTS.

(1) HORIZONTAL AND VERTICAL CENTERING CONTROLS. *(See figure 7-2.)*

(*a*) Horizontal and vertical centering controls are located on the cathode ray indicator chassis, just to the right of the tube shield. These controls have insulated slotted shafts. They should be adjusted with a screwdriver to center the base line horizontally and approximately one-third of the tube diameter up from the bottom.

(2) AXIS ALIGNMENT OF CATHODE RAY TUBE.

(*a*) Axis alignment is accomplished by rotating the cathode ray tube until the base line is horizontal. With the unit in operation, carefully loosen the two screws which hold the socket mounting ring in place about one-half turn. (See figure 7-1.)

WARNING

Do not loosen these screws more than ¾ turn because the nuts on these screws have ridges which fit into the slots of the mounting ring on the tube socket.

(*b*) Rotate the tube socket for proper alignment and tighten the mounting screws.

(3) PULSE RECURRENCE RATE CALIBRATION *(PRR Cal.)* ADJUSTMENT.—The range of

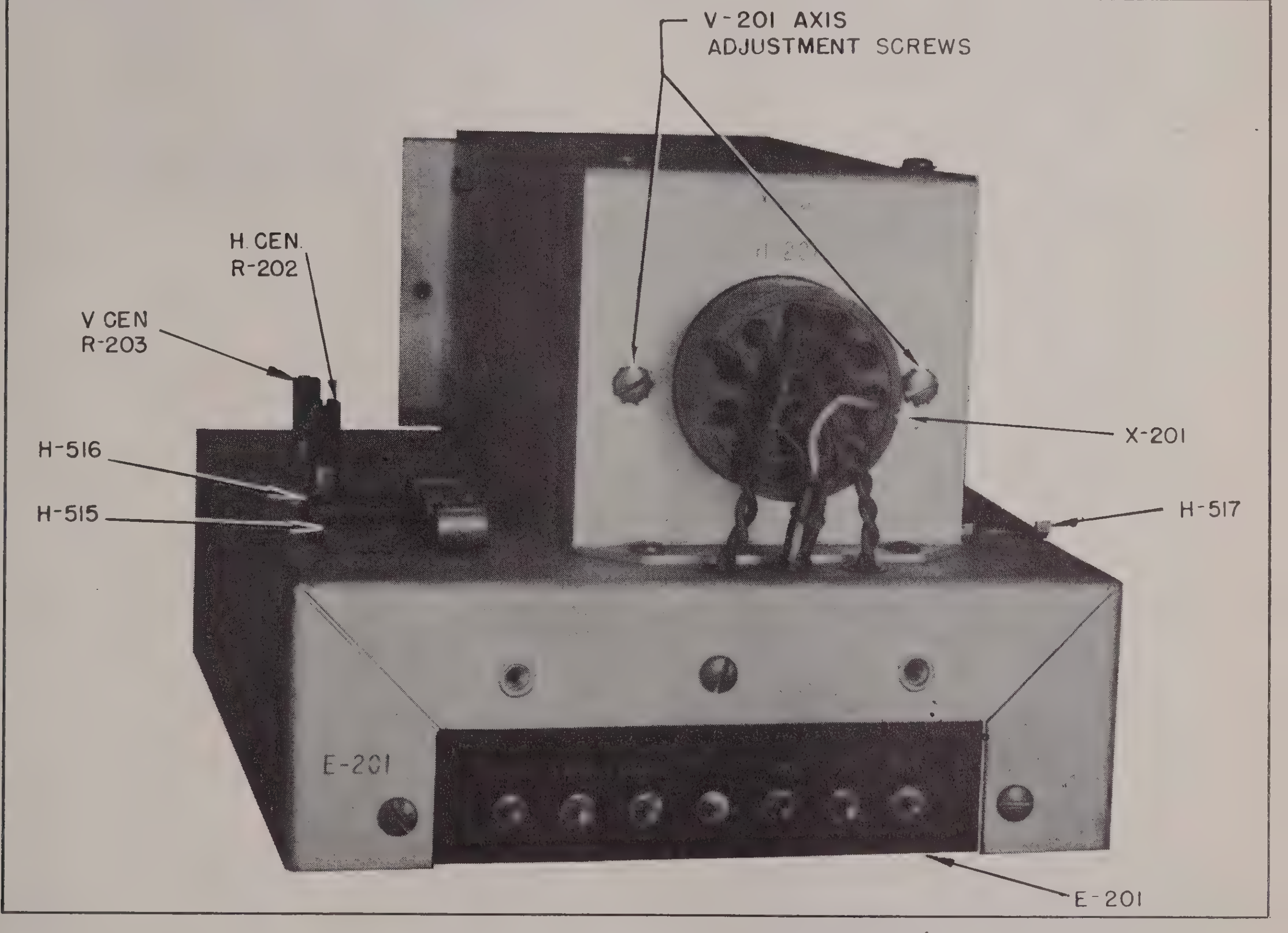


Figure 7–2. Cathode Ray Indicator Unit, Rear View

PRR Cal. control is adjusted by the manufacturer so that there is approximately an equal amount of compensation for temperature effect and drift in the Sweep Generator Unit either side of the midway position. The control is in mid-position when the line on the *PRR Cal.* knob lines up with the line on the panel; however, if any change is made in the Sweep Generator Unit such as replacing V-101 or a component in the associated circuit, the compensating

range of the control may shift enough to require complete readjustment. Complete resetting of the *PRR Cal.* control is performed as follows:

(a) Remove the Field Intensity Meter IM-10/UP or IM-14/UP from its case and set it in its normal operating position close to a Model DAS or DAS-2 Radio Navigation Equipment.

(b) Detach the Cathode Ray Tube Indicator from the front panel and fold it back without disconnecting the connections to terminal board E-201.

(c) Connect the Generator Output Adapter to the Loop Antenna pedestal and insert the pedestal carefully into its receptacle, J-301, on the Receiver.

(d) Remove the Antenna lead from its connector on the Radio Navigation Equipment, attach the center lead clip of the adapter to the center terminal of the antenna connector and attach the shield braid clip to a ground point nearby.

(e) Turn both equipments on and allow them to warm up for at least 20 minutes.

(f) Check the alignment of the radio navigation equipment in accordance with the instructions given in Section III "Operation" of the Model DAS and DAS-2 Instruction Book.

(g) After the alignment is completed, set the navigational receiver controls as follows:

Receiver to "ON"
Filter to "OUT"
Channel to "1"
Sweep Speed to "1"
Station to "0"
Balance centered

(h) On the Field Intensity Meter, set the controls as follows:

Basic PRR to "L"
Specific PRR to L-0 reading (See Calibration Chart Table No. 1)
Selector to "Pulse"
Multiply By to "100"
R.F. Level set for approximately 150 on RF Level meter
PRR Cal.—align dial mark with the panel mark

Four upward projecting pulses will be present on the Model DAS or DAS-2 indicator screen because the Receiver-Indicator sweep represents approximately ½ of a recurrence interval on the "L" range or 19,500 microseconds.

(i) Adjust C-115 and C-116 (See figure 7-3) until the pulses remain stationary on the Receiver-Indicator screen. This adjustment should be balanced between the two capacitors so that they are in their approximate mid-positions when the pulses are stationary.

(j) Disconnect the equipment and reassemble the Field Intensity Meter.

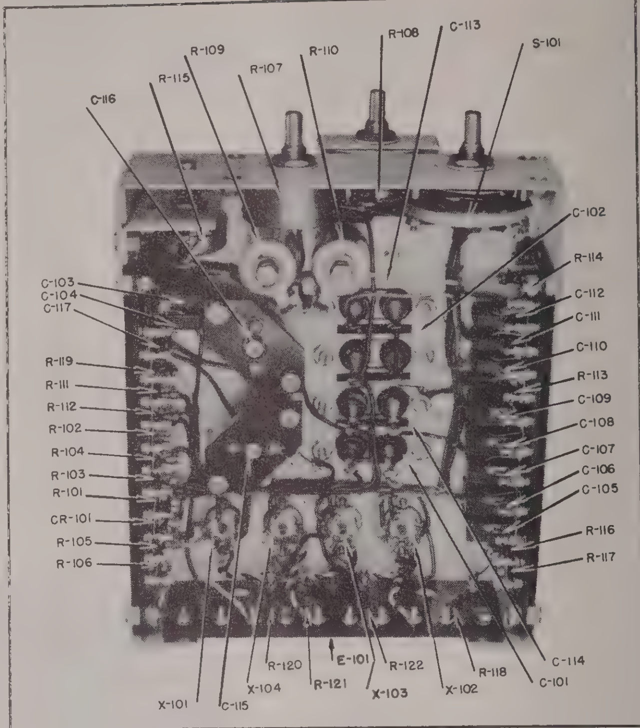


Figure 7–3. Sweep Generator Unit, Bottom View

(4) CALIBRATION OF *SPECIFIC PRR* DIAL USING MODEL DAS OR DAS-2 RADIO NAVIGATION EQUIPMENTS.

(a) Repeat steps *(a)* through *(i)* of Sec. 7-4*a*(3) except the Field Intensity Meter IM-10/UP or IM-14/UP is not removed from its case.

(b) Adjust *PRR Cal.* until the pulses on the Model DAS/DAS-2 screen are stationary.

(c) Turn the *Station* control on the Model DAS/DAS-2 to 1 and turn the *Specific PRR* dial until the pulses are again stationary on the screen. The reading on the *Specific PRR* dial should agree with the L-1 reading on Calibration Chart Table No. 1.

(d) Repeat step *(c)* for all steps on the Model DAS/DAS-2 *Station* switch to recheck the readings under the "L" rate on the chart table.

(e) Disconnect the equipment and the Field Intensity Meter may be used to measure the pulse recurrence rates of Loran station pairs.

(5) CALIBRATION OF *SPECIFIC PRR* DIAL USING A LORAN SIGNAL HAVING A KNOWN PULSE RECURRENCE RATE.

(a) Set *Selector* and *Meter* switches to "OFF" and *Multiply By* dial to position "1."

(b) Tune the *Receiver Tuning* to the frequency of a Loran station pair whose pulse recurrence rate (PRR) is known. See Calibration Chart No. 7, *Receiver Frequency Calibration.*

(c) Set *Basic PRR* and *Specific PRR* dials to the known pulse recurrence rate. See Calibration Chart Table No. 1, *Specific PRR Dial Readings.*

(d) Adjust *RF* and *IF* Gain controls until pulses can be seen on the cathode ray tube screen. If the known station is a "single slave" pulsing at only one rate or only one pair of pulses can be seen on the screen and it is known the desired station is the only one on the RF frequency channel at the time, proceed with step *(e)*. However, if several pairs of signals travelling at various speeds are observed on the screen or the known station is a "double slave" pulsing at two rates, the direction finding properties of the loop antenna must be employed.

When the field intensity meter is close to the known station, its signals will be easily recognized from any others present on the screen because its pulses will be much higher. If all of the pulses are the same height, rotate the loop antenna until the height of one of the pulses is reduced to a minimum. Knowing the direction of the known station from the field intensity meter position, it can be decided if a line perpendicular to the plane of the loop antenna points toward the known station. If it does, proceed with step *(e)* otherwise this same procedure must be applied to all visible signals until the direction indicated by the loop antenna agrees with the position of the known station.

The reading of the *Specific PRR* dial may be used to distinguish between a number of different pulse rates such as used by a "double slave" station or several "single slave" stations visible on the screen at one time since the dial readings are such as to increase with increasing specific pulse rates. Knowing that the known station has two pulse rates adjust the *Specific PRR* dial until one set of pulses is stationary. Note this reading and adjust the dial until the next pair of pulses are "locked" on the screen. The lowest recurrence rate will correspond to the lowest *Specific PRR* dial reading. Proceed with step *(e)* using either of the known pulse rates to calibrate the *Specific PRR* dial.

(e) Rotate the Loop Antenna and adjust the *Ant. Trim.* control for maximum pulse height.

(f) Adjust *PRR Cal.* until the pulses are stationary on the screen.

(g) Set *Selector* switch to "Pulse" and tune *Generator Tuning* to the dial setting corresponding to the frequency of the station pair. See Calibration Chart No. 8.

(h) If the *Basic PRR* knob is set to "S," ten calibrating pulses should appear on the cathode ray tube screen. On the "L" or "H" *Basic PRR* ranges, 8 and 6 calibrating pulses, respectively, should be present. If there are more or fewer pulses than there should be, turn the *PRR Adj.* screwdriver adjustment on the front panel until the correct number of pulses for the particular range is obtained on the screen.

(i) Rotate the *Specific PRR* control through its calibrated range for each *Basic PRR* setting. (See Calibration Chart Table No. 1.) The correct number of pulses should remain on the cathode ray tube screen otherwise closer adjustment of *PRR Adj.* is required.

(6) SIGNAL GENERATOR TUNING ADJUSTMENT, TS-318/UP.

(a) Remove the bottom plate from the Signal Generator and set the Field Intensity Meter in the normal position with the Signal Generator end projecting beyond the edge of the work bench.

(b) Couple a heterodyne frequency meter, one of the LM series, which has a range of 1,550 to 2,500 kc., to the Loop Antenna by a couple of turns of the connecting lead around the loop.

(c) Set the *Selector* to "CW" and the *Generator Tuning* dial to the dial setting corresponding to 2,500 kc. from Chart No. 8.

(d) Set the heterodyne frequency meter to 2,500 kc. and vary the adjustment on T-401, which is in the underside of the Signal Generator (See figure 7-4), until zero beat is heard in output of the heterodyne frequency meter.

(e) Readings of the *Generator Tuning* dial may now be translated into RF frequencies by use of Chart No. 8.

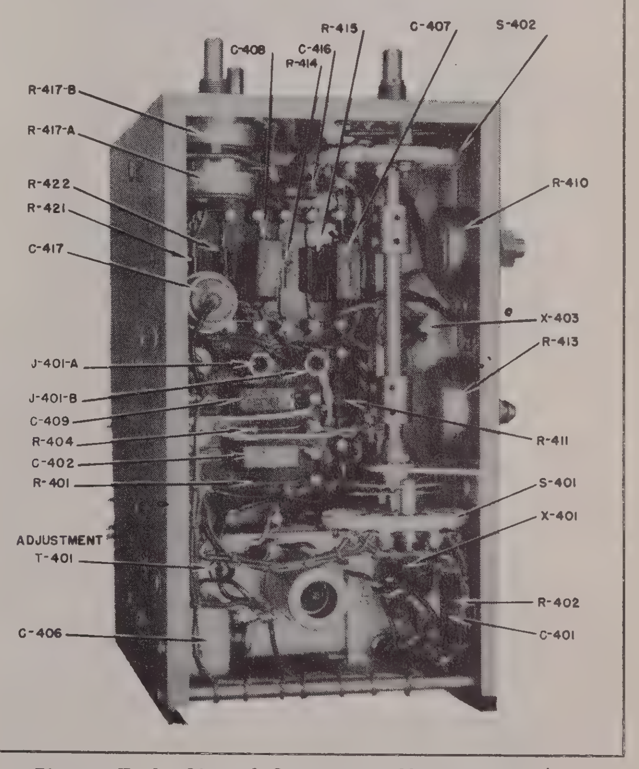


Figure 7–4. Signal Generator Unit, IM–10/UP, Bottom View

(7) SIGNAL GENERATOR TUNING ADJUSTMENTS, TS-635/UP.—This adjustment is accomplished in the same way as described for TS-318/UP except that the frequency range of the heterodyne frequency meter should be 110 kc. to 220 kc.

(8) VACUUM TUBE VOLTMETER *FS ADJ.* AND *CW ADJ.* ALIGNMENT.—These variable resistors are located on the side of the Signal Generator chassis.

Note

IN THE SIGNAL GENERATOR USED WITH TS-635/UP THESE ADJUSTMENTS AND THE SWITCH FOR CHANGING THE CALIBRATING PULSE WIDTHS ARE MOUNTED ON THE SIDE OF THE SIGNAL GENERATOR CHASSIS. (See figure 7-5.)

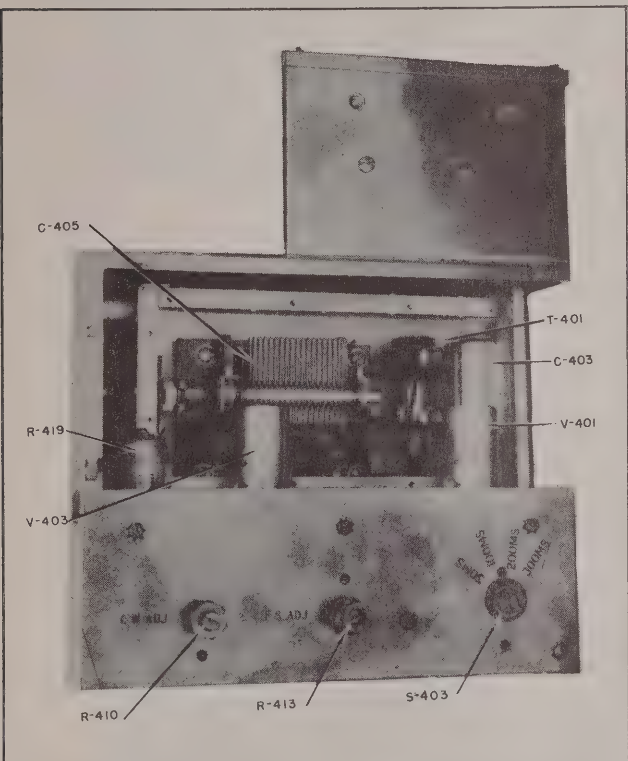


Figure 7–5. Signal Generator Unit, IM–14/UP, Side View

(a) Remove the Field Intensity Meter from its case and remove the bottom panel from the Signal Generator Unit by sliding it away from the panel.

(b) Start the equipment, set *Selector* to "Pulse" and turn the *RF Level* control to the extreme counter-clockwise position.

(c) Rotate the *Zero Adj.* control until the *RF Level* meter reads "0."

(d) Turn the *RF Level* control until the *RF Level* meter reaches a maximum and begins to fall toward a lower value. This position will be almost to the extreme clockwise stop of the *RF Level* control.

(e) Set the *RF Level* meter to full scale by adjusting the *FS Adj.*

(f) Connect an external high frequency oscilloscope, such as a Navy Model OBT or equivalent, by means of its probe, to J-401.

Note

THIS JACK IS DESIGNED TO RECEIVE A STANDARD DOUBLE "BANANA" TYPE PLUG WITH ¾" SPACING AND IS LOCATED ON THE UNDERSIDE OF THE SIGNAL GENERATOR CHASSIS. (See figure 7-4.)

(g) Adjust the *RF Level* control for an *RF Level* meter reading, such as 150, and record the pulse height on the external oscilloscope. Set the oscilloscope sweep so that the individual pulses can be easily defined on the screen.

(h) Set *Selector* to "CW" and adjust the *Zero Adj.* to give the same deflection on the external oscilloscope obtained in Sec. 7-4*a*(6)*(g)*.

(i) Rotate the *CW Adj.* until the *RF Level* meter reads 150.

Note

THE *CW ADJ.* CONTROL HAS A LOCKING BUSHING TO MAINTAIN ITS SETTING UNDER ALL CONDITIONS. BE SURE TO LOOSEN THIS LOCKING BUSHING BEFORE MAKING THE ADJUSTMENT AND TIGHTEN IT AFTERWARD.

(9) RECEIVER ADJUSTMENTS.

(a) INTERMEDIATE FREQUENCY ALIGNMENT.—The alignment procedure for the receivers in Field Intensity Meters IM-10/UP and IM-14/UP is identical and also same as the standard procedure for any superheterodyne receiver with double tuned, iron core, 455 kc. IF transformers. The *CW and Test* meter may be used as a tuning indicator or an external output meter may be connected to the receiver output through the *Video Output* jack.

The primary adjustment is located on the bottom of each IF transformer and the secondary adjustment is on the top. Each adjustment screw is covered by a screw cap and water-proofing gasket which must be replaced after the alignment is completed. (See figure 7-11.)

(b) OSCILLATOR AND RF AMPLIFIER ADJUSTMENT.—These "tracking" adjustments are made in the same order for receivers in Field Intensity Meters IM-10/UP and IM-14/UP; however, the IM-10/UP receiver is checked at 1.55 mc. and 2.5 mc. while the IM-14/UP receiver is checked at 115 kc. and 220 kc. Both receivers have the same adjustments except the low frequency receiver has a variable padding capacitor, C-315, in series with the oscillator winding, Z-302.

With the loop antenna in place and a signal supplied either from an external signal generator at-

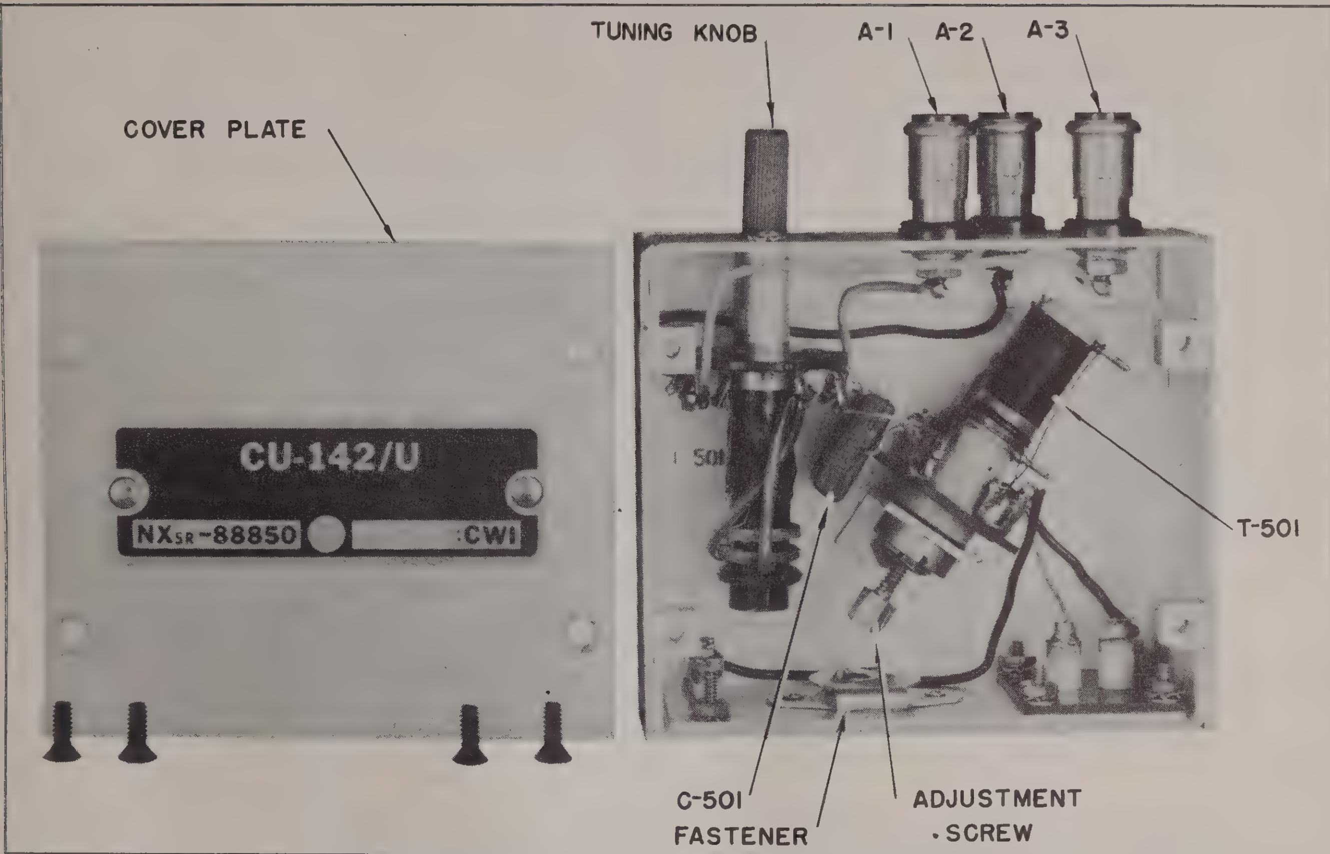


Figure 7–6. Antenna Coupler CU–142/U, Cover Removed

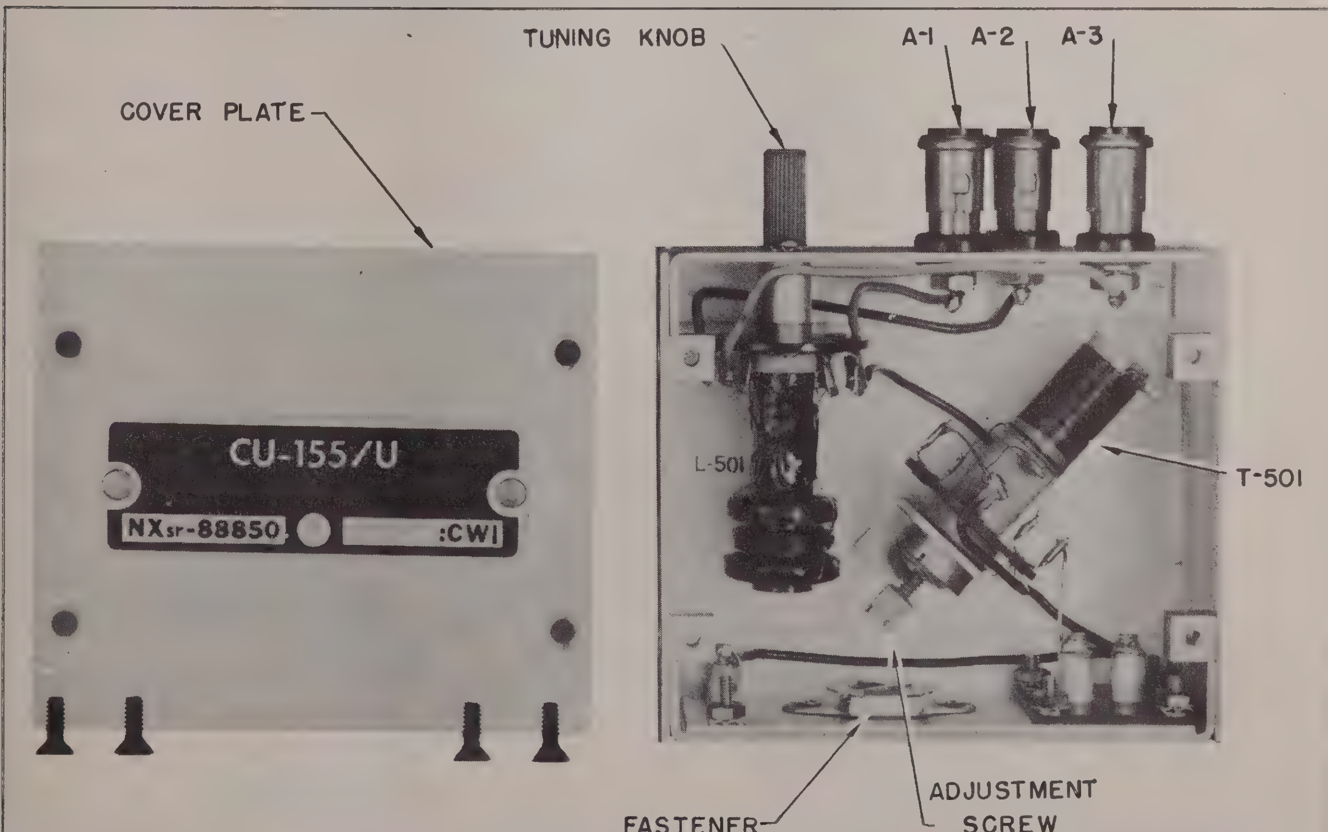


Figure 7–7. Antenna Coupler CU–155/U, Cover Removed

tached to an antenna close to and in the same plane as the loop or using the Signal Generator Unit incorporated in the Field Intensity Meter, adjust Z-301, Z-302, and C-302 for maximum output at the low frequency check point with C-305 at its midposition. If the IM-14/UP receiver is being aligned, C-315 and Z-302 should be adjusted.

At the high frequency check point, adjust C-305 and C-302 for maximum output. Rotate the adjustment of Z-301. If the output increases with increased inductance of Z-301, the inductance of Z-302 must be decreased. Conversely, if decreasing the inductance of Z-301 causes increased output, the inductance of Z-302 must be increased. If either of these conditions exist, a more appropriate setting of C-305 should be chosen and the tracking procedure repeated until the peaking of Z-301 results in no changes in the output meter reading.

(10) ADJUSTMENT OF ANTENNA COUPLER CU-142/U. *(See figure 7-6.)*

(a) Remove the cover plate from the Coupling Unit and attach the unit to the Loop Antenna pedestal.

(b) Insert the pedestal into its receptacle on the Field Intensity Meter and set the equipment into operation.

(c) Set *Selector* and *Meter* switches to "CW" and tune *Generator Tuning* to 2 mc. (See Calibration Chart No. 8.)

(d) Tune *Receiving Tuning* to resonate with the 2 mc. signal as indicated by a dip in indication of the *CW and Test* meter.

(e) Set *RF* and *IF Gain* controls to obtain a meter reading of approximately .7.

(f) Adjust the phenolic tuning knob on top of the Coupling Unit to obtain a maximum meter deflection. Normally a large portion of the core adjustment screw will protrude from the coil at resonance.

(g) Connect a 50 mmfd. mica capacitor between terminal A-3 and the Coupling Unit case and adjust the tuning screw on the coupling transformer, T-501, with a small wrench until resonance is indicated again on the *CW and Test* meter at a reading of approximately .3.

Note

T-501 WILL NEED NO FURTHER ADJUSTMENT.

(h) Remove the capacitor from terminal *A-3* and connect a 100 mmfd. capacitor between terminal *A-2* and the Coupling Unit case.

(i) Tune the CW and Test meter for a dip in indication by rotating the phenolic tuning knob.

(j) Remove the capacitor from terminal *A-2* and connect a 250 mmfd. capacitor between terminal *A-1* and the Coupling Unit case.

(k) Readjust the phenolic tuning knob for a dip in the indication of the *CW and Test* meter.

Note

THE DIP READINGS FOR STEPS *(j)* AND *(k)* SHOULD BE AS LOW AS, IF NOT LOWER THAN, STEP *(g)*. A CONSIDERABLY HIGHER DIP READING INDICATES A LACK OF SENSITIVITY DUE TO A DEFECTIVE SERIES COIL L-501 OR OTHER COMPONENT.

(l) Replace the cover and the Coupling Unit is ready for use.

(11) ADJUSTMENT OF COUPLING UNIT CU-155/U. *(See figure 7-7.)*—The adjustment of this Coupling Unit is accomplished in the same manner as described in Sec. 7-3*a*(10) except that the test frequency should be approximately 160 kc.

b. MECHANICAL REMOVAL OF UNITS FOR REPAIR.

(1) POWER SUPPLY. *(See figure 7-8.)*—Replacement of parts in this unit, except for tubes, requires the removal of the panel and the plate covering the bottom of the chassis. The panel is arranged so that after the panel mounting screws, power switch knob, 115 V. receptacle, 6 V. external battery board, and the fuse boards are detached from the panel, it may be moved out of the way without disconnecting the output receptacle cable.

The chassis bottom plate is held in place by screws which can easily be removed.

(2) FIELD INTENSITY METERS IM-10/UP AND IM-14/UP.

(a) CASE.—Turn the ten screwdriver operated fasteners, around the edge of the panel, counterclockwise with a screwdriver. Pull the Field Intensity Meter out by means of the two handles.

(b) CATHODE RAY INDICATOR UNIT.—The underside of the chassis of this unit may be exposed by removing the black screws which hold the unit against the panel and swinging the chassis away from the panel without disconnecting the attached terminal board wiring. Four screws hold the dust cover plate on the bottom of the chassis. Removal of this unit also permits inspection and replacement of parts on the underside of the Sweep Generator chassis. (See figure 7-9.)

Access to the terminals in the rear of this unit is made by removing the screws holding the cover plate over the terminal board.

WARNING

1,000 V. under this plate. Take safety precautions.

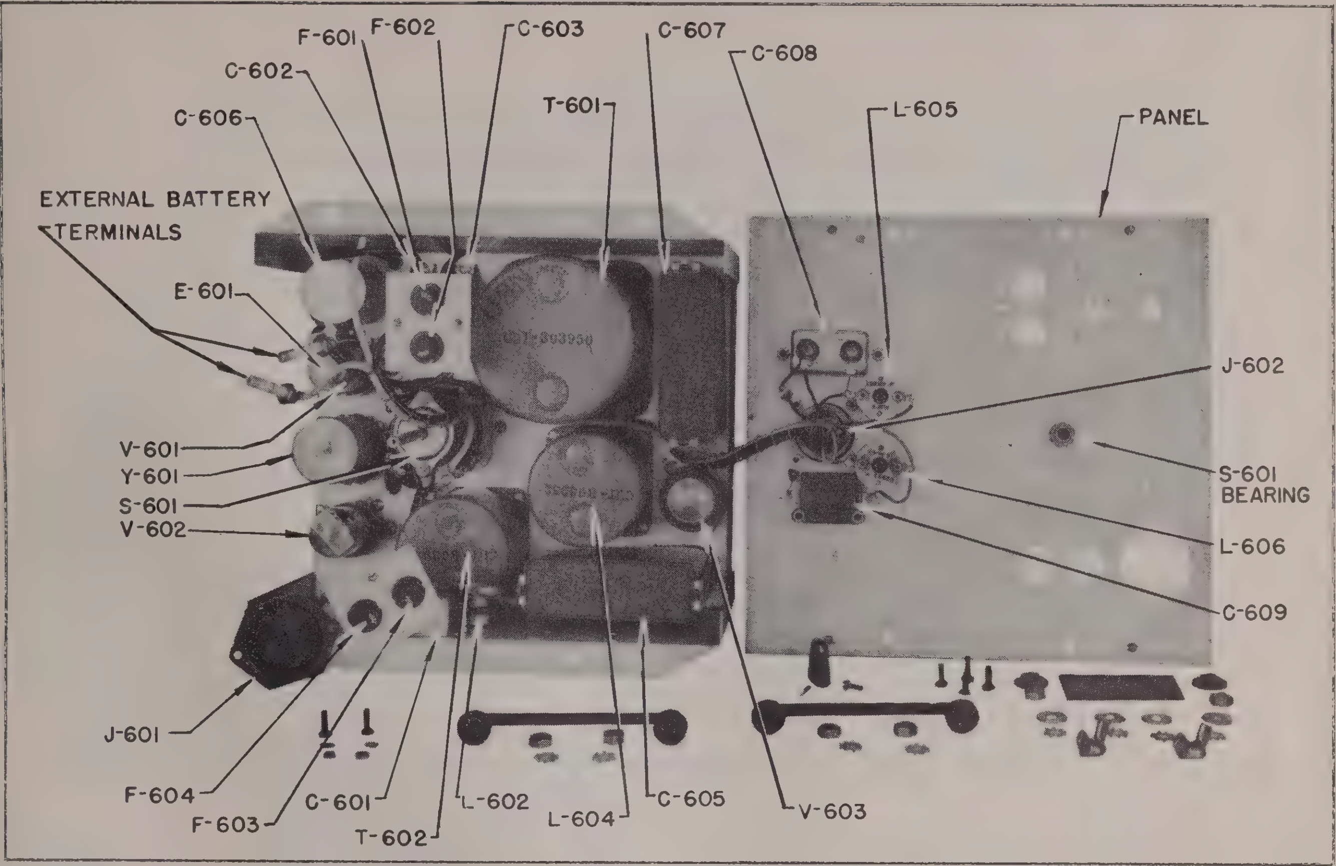


Figure 7–8. Power Supply PP–287/U, Panel Folded Back

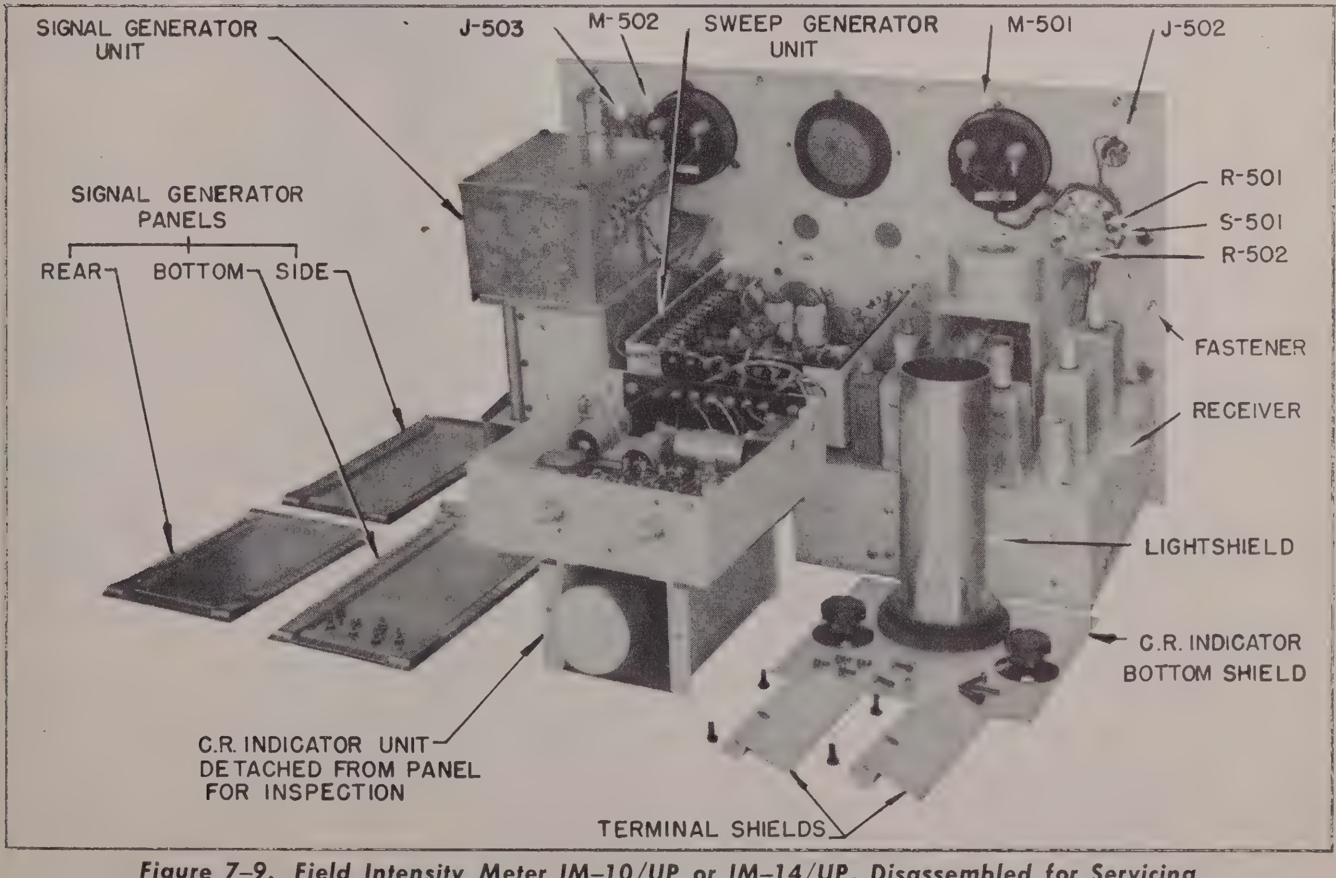


Figure 7–9. Field Intensity Meter IM–10/UP or IM–14/UP, Disassembled for Servicing

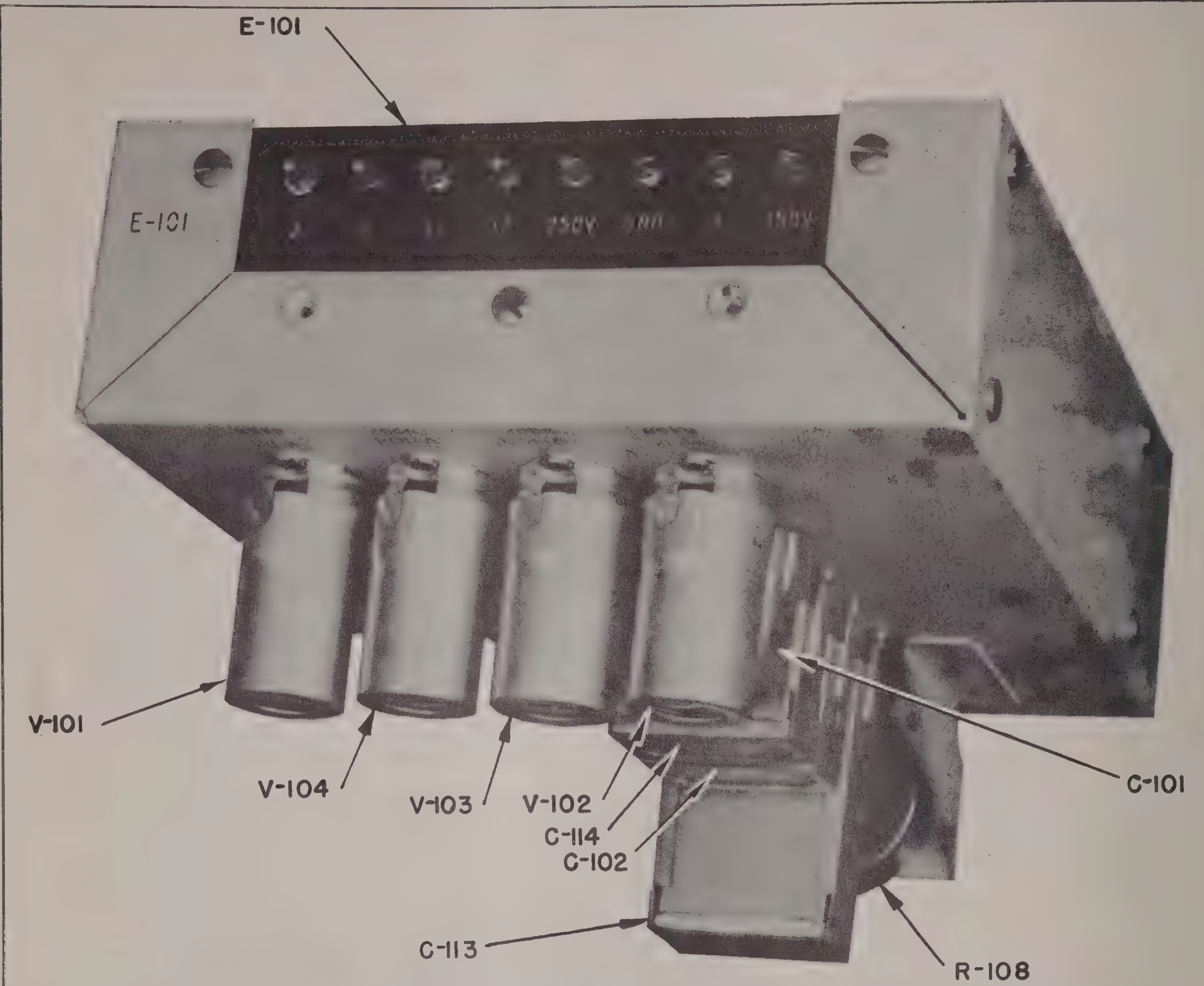


Figure 7–10. Sweep Generator Unit, Rear View

(c) SWEEP GENERATOR UNIT.—The four tubes in this unit may be reached after the case has been removed. (See figure 7-9.) The Cathode Ray Tube Indicator must be detached from the front panel and folded back as shown in Fig. 7-9 when it is necessary to inspect or replace components under the Sweep Generator Unit chassis.

Complete removal of the unit from the front panel is accomplished by removing the four retaining screws and detaching the cable from the terminal board.

(d) RECEIVER.—The tubes in this unit are accessible after the Field Intensity Meter has been removed from the case. (See figure 7-11.) The bottom of the chassis can be examined by turning the entire Field Intensity Meter upside down and removing the shield plate, held by three screws, which covers one corner of the chassis.

To completely remove the Receiver, disconnect the power leads and output connections to the C.R. Indicator. Keep the connections to the *Meter* switch and *Video Output* jack intact and unfasten the switch and jack from the front panel along with the four screws which hold the chassis to the panel.

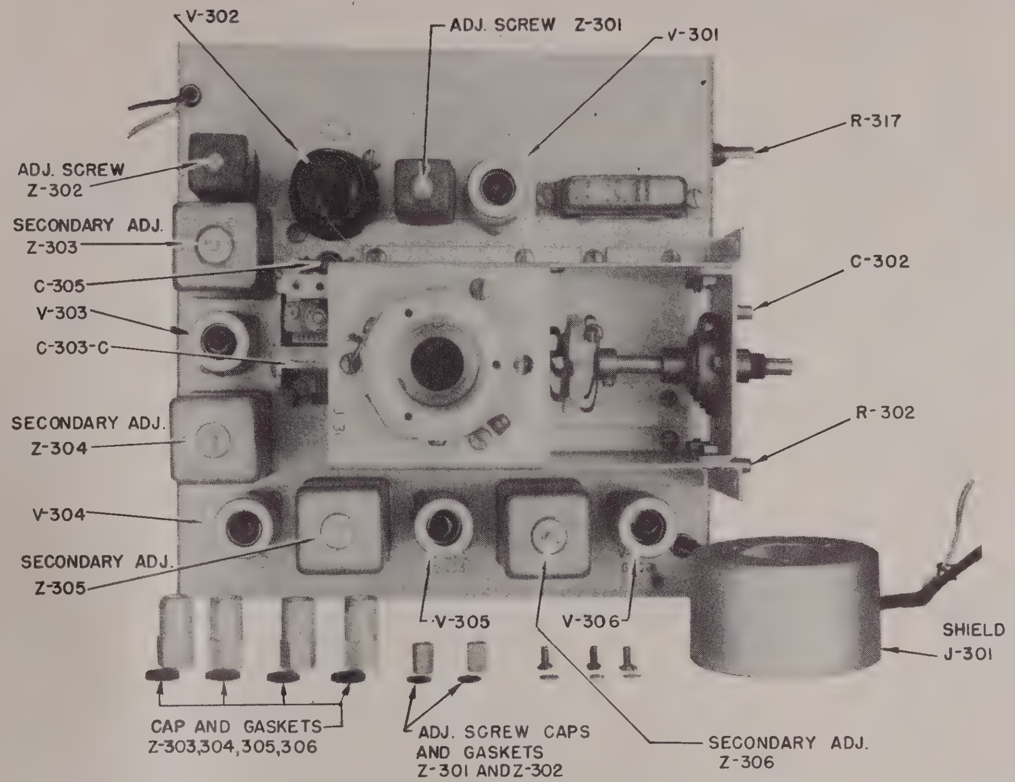


Figure 7–11. Receiver, IM–10/UP, Top View

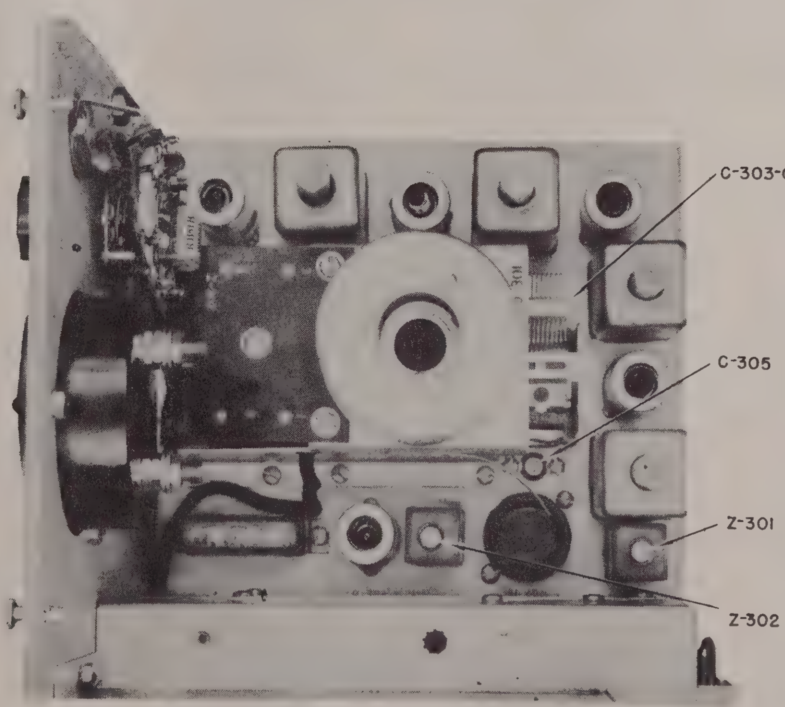


Figure 7–12. Receiver, IM–14/UP, Top View

c. ELECTRON TUBE CHARACTERISTICS.

TABLE 7–11. TUBE CHARACTERISTICS

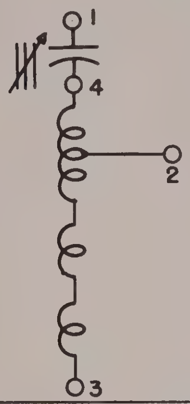
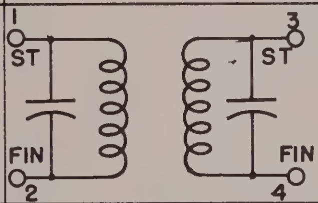
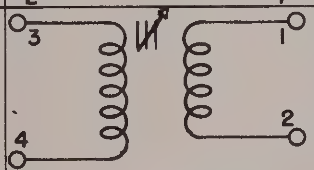
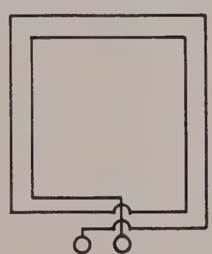
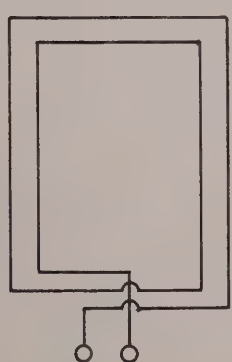
TUBE TYPE	FILAMENT VOLTAGE (VOLTS)	FILAMENT CURRENT (AMPERES)	PLATE VOLTAGE (VOLTS)	GRID BIAS (VOLTS)	SCREEN VOLTS	PLATE CURRENT (MA)	SCREEN CURRENT (MA)	AC PLATE RESIS. (OHMS)	VOLTAGE AMPLIFICATION FACTOR (MU)	TRANSCONDUCTANCE		EMISSION	
										NORMAL	MINIMUM	IS (MA)	TEST VOLT
6X5GT/G	6.3	0.6	Max. DC Output Current—70 ma. Max. Inverse Peak Volts—1250 V. Peak Current Per Plate—210 ma.									140 each section	50 VDC
6AK5	6.3	0.175	120	Rk—200 ohm	120	7.5	2.5	340 M	1700	5000	3500	—	—
6AL5	6.3	0.3	Resonant frequency of each unit approx. 700 megacycles. Max. peak volts—150 V. rms. at 9 ma. per plate; peak plate current 54 ma. max.									40 ma. per section	10 VDC
6AS6	6.3	0.175	120	−2	120	5.2	3.5	—	—	3200	2500	—	—
6AQ6	6.3	0.15	250	−3	—	1.0	—	58 M	70	1200	900	.3 ma. dc per diode 25 ma. dc (triode)	10 VDC 30 VDC
6SA7	6.3	0.3	250	0*	100	3.4	8.0	800 M	Grid Resistor #1—20,000 ohm			70	30
OA3/VR-75	—	—	Min. starting volts—105; operating volts—75; operating current 5-30 ma.**									—	—
OD3/VR-150			Min. starting volts—180; operating volts—150; operating current 5-30 ma.**										
8016	1.25	0.2	Max. DC Output Current—2.0 ma. Max. Inverse Peak Volts—10,000 V. Max. Plate Crurent—7.5 ma.									2.0	100
9002	6.3	0.15	250	−7	—	6.3	—	11400	25	2200	1700	20	15
9003	6.3	0.15	250	−3	100	6.7	2.7	.7 meg.	—	1800	1300	20	15

CATHODE RAY TUBE

TUBE TYPE	FILAMENT VOLTS	FILAMENT CURRENT (AMP.)	ANODE #2 VOLTS	ANODE #1 VOLTS	CUT-OFF GRID VOLTS	MAX. #1 CURRENT RANGE	DEFLECTION FACTOR VDC/IN		DEFLECTION SENS. MM/VDC		SCREEN PERSISTENCE	PATTERN COLOR	
							D_1D_2	D_3D_4	D_1D_2	D_3D_4			
2AP1A	6.3	0.6	1000	250	−60	−50 to +10 ma.	230	196	0.11	0.13	P1	green	

*Grid bias—2 volts if separate oscillator is used.
**Sufficient resistance must be used in series with tube to limit current to 30 ma.

TABLE 7-12. WINDING DATA (Continued)

TS-635/UP	TS-318/UP	Symbol Desig.	WIT Part No.	Diagram	Winding	Wire Size	Turns	DC Resis.	Remarks
x		Z-302	21147-1		3 pi sections universal	#34 SSE all secs.	#1-160 tapped at 33 #2 & #3 130T		Meissner Hi Q over coils. Each pi 3/32" wide, spacing 1/8" dia.
x	x	Z-303 304 305 306	125-035-1		universal	5/44 Litz	pri.- 400 sec.- 520		Coils 7/32" wide, spaced 3/16"
x		Z-307	21140-1		pri. single layer sec. - universal 1/2" wide	#30 SEE #15-44 Litz	35 378		Meissner Hi Q over coils. Sec. #1-#2 wound over pri. #3-#4 separated by 2 layers elect. tape.
	x	AS-377/U	Loop 4265-1 Pedestal 3827-1			#26E	6T		
x		AS-400/UP	Loop 4265-36 Pedestal 3827-1			#26E	12T		

c. ELECTRON TUBE CHARACTERISTICS.

TABLE 7–11. TUBE CHARACTERISTICS

TUBE TYPE	FILAMENT VOLTAGE (VOLTS)	FILAMENT CURRENT (AMPERES)	PLATE VOLTAGE (VOLTS)	GRID BIAS (VOLTS)	SCREEN VOLTS	PLATE CURRENT (MA)	SCREEN CURRENT (MA)	AC PLATE RESIS. (OHMS)	VOLTAGE AMPLIFICATION FACTOR (MU)	TRANSCONDUCTANCE NORMAL	TRANSCONDUCTANCE MINIMUM	EMISSION IS (MA)	EMISSION TEST VOLT
6X5GT/G	6.3	0.6	Max. DC Output Current—70 ma. Max. Inverse Peak Volts—1250 V. Peak Current Per Plate—210 ma.									140 each section	50 VDC
6AK5	6.3	0.175	120	Rk—200 ohm	120	7.5	2.5	340 M	1700	5000	3500	—	—
6AL5	6.3	0.3	Resonant frequency of each unit approx. 700 megacycles. Max. peak volts—150 V. rms. at 9 ma. per plate; peak plate current 54 ma. max.									40 ma. per section	10 VDC
6AS6	6.3	0.175	120	−2	120	5.2	3.5	—	—	3200	2500	—	—
6AQ6	6.3	0.15	250	−3	—	1.0	—	58 M	70	1200	900	.3 ma. dc per diode 25 ma. dc (triode)	10 VDC 30 VDC
6SA7	6.3	0.3	250	0*	100	3.4	8.0	800 M	Grid Resistor #1—20,000 ohm			70	30
OA3/VR-75	—	—	Min. starting volts—105; operating volts—75; operating current 5-30 ma.**									—	—
OD3/VR-150			Min. starting volts—180; operating volts—150; operating current 5-30 ma.**										
8016	1.25	0.2	Max. DC Output Current—2.0 ma. Max. Inverse Peak Volts—10,000 V. Max. Plate Crurent—7.5 ma.									2.0	100
9002	6.3	0.15	250	−7	—	6.3	—	11400	25	2200	1700	20	15
9003	6.3	0.15	250	−3	100	6.7	2.7	.7 meg.	—	1800	1300	20	15

CATHODE RAY TUBE

TUBE TYPE	FILAMENT VOLTS	FILAMENT CURRENT (AMP.)	ANODE #2 VOLTS	ANODE #1 VOLTS	CUT-OFF GRID VOLTS	MAX. #1 CURRENT RANGE	DEFLECTION FACTOR VDC/IN D_1D_2	DEFLECTION FACTOR VDC/IN D_3D_4	DEFLECTION SENS. MM/VDC D_1D_2	DEFLECTION SENS. MM/VDC D_3D_4	SCREEN PERSIST-TENCE	PATTERN COLOR	
2AP1A	6.3	0.6	1000	250	−60	−50 to +10 ma.	230	196	0.11	0.13	P1	green	

*Grid bias—2 volts if separate oscillator is used.
**Sufficient resistance must be used in series with tube to limit current to 30 ma.

d. WINDING DATA.

TABLE 7-12. WINDING DATA

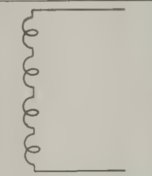
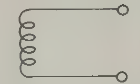
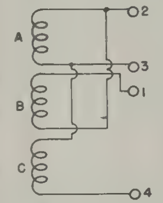
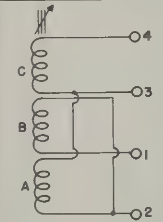
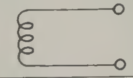
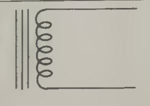
TS-635/UP	TS-318/UP	Symbol Desig.	WIT Part No.	Diagram	Winding	Wire Size	Turns	DC Resis.	Remarks
x	x	L-401 402 403 404	85-039-101		4 pi sections 2-2/3-X universal	#39 SEE	253 per pi 1012 total	69.1	2.5 millihenries ±5%, 3/32" width per pi, 1/16" spacing between sections.
x	x	L-405	85-053-101		4 layer winding	#20E	75	0.2	50 microhenries at 0.75 amp.
x		L-501	21178-1		3 pi sections universal	#3-41 Litz	A-250T B-200T C-300T		Meissner Hi Q over coils. Sections spaced over 9/16".
	x	L-501	21091-1		3 pi sections universal	#15-44 Litz SE			Inductance: 16 microhenries in air each pi. Meissner Hi Q over coil. Each pi 3/32" wide spaced over 3/8".
x	x	L-601 602	85-047-101		single pi universal	#29 SCCE	117	2.5	300 microhenries at 0.5 amp. pi dia. - 1-1/16" pi width - 7/32"
x	x	L-603	85-052		4 layers layer #1-14T layer #2-13T layer #3-12T layer #4-11T	#15E	50		72 microhenries at 1000 cycles, iron core.

TABLE 7-12. WINDING DATA (Continued)

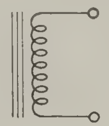
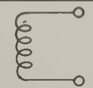
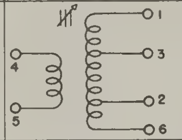
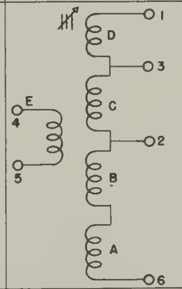
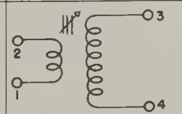
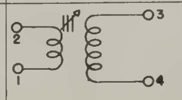
TS-635/UP	TS-318/UP	Symbol Desig.	WIT Part No.	Diagram	Winding	Wire Size	Turns	DC Resis.	Remarks
x	x	L-604	85-038-1		single winding	#31	3200	233.4	Inductance: 15 henries at 75 ma. Vacuum varnish impregnated, Kerite #4 potting
x	x	L-605, 606	85-051-101		single pi 2-X universal	#36 SSE	260	25 ohms max.	1 millihenry at 70 ma.
	x	T-401	3848-1		pri. #1-#6 sec. #4-#5	#34 enameled #30 enameled	128 tapped at 42(#2) and 92(#3) 7		Sec. wound over pri. End #4 opposite to tap #3
x		T-401	3940-1		4 pi sections universal	#34 SEE	D-100 E-80 C-275 B-361 A-175		Wind D first, E next with C over E separated by 2 layers of RF tape. Wind B next and A last. Seal ends of windings with Zephar Mills wax #1340. Cover coils with Meissner Hi Q. Spacing CE to D - 1/16", other spacings 3/32".
	x	T-501	21052-1		winding #1-#2 winding #3-#4	#24E #26E	2 50		Winding #1-#2 placed over end #4. Meissner Hi Q over coil.
x		T-501	21175-1		pri. single layer sec. single layer	#30E #30E	2 75		Wind pri. over bottom (#4) end of sec. separated by elect. tape. Ends secured with Zophar Mills wax #1340. Meissner HiQ over coils.

TABLE 7-12. WINDING DATA (Continued)

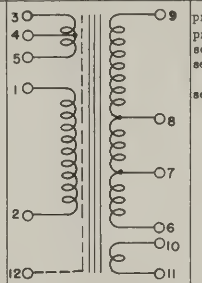
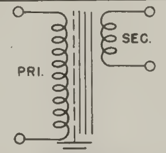
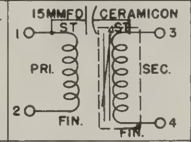
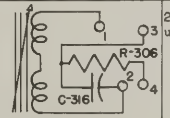
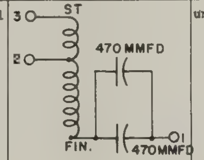
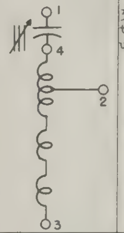
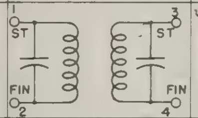
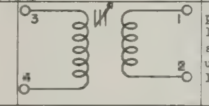
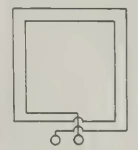
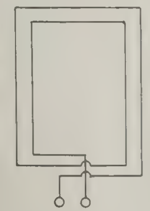
TS-635/UP	TS-318/UP	Symbol Desig.	WIT Part No.	Diagram	Winding	Wire Size	Turns	DC Resis.	Remarks
x	x	T-601	125-032-1		pri. #1-#2 pri. #3-#5 sec. #10-#11 sec. #6-#8 sec. #8-#9	#28E #16E #30E #34E #38E	622 48 C.T. 7 2800 C.T. 3400	25 0.125 0.45 310 1400	Pri. #3-#5 shielded, shield grounded to case. #10-#11 - 1.25 V. at 2 amp. #7-#8 - 250 V. at 70 ma. #7-#6 - 250 V. at 70 ma. #7-#9 - 900 V. at 2 ma.
x	x	T-602	125-031-1		primary secondary	#29E #17E	855 58	33.3 .18	Pri.: 115 V., 60 cycle. Sec.: 6.3 V. ±5%, at 3.5 amp. Vacuumvarnish impregnated, Kerite #4 potting
	x	Z-301	125-028-101		universal primary secondary	#36SSE 1044 SSE	581 83		Pri.: 2 microhenries, ±5% in air Sec.: 49.9, ±3% in air.
x		Z-301	21146-1		2 sections universal	#37 SSE			2 coils series aiding. Meissner Hi Q. Each section 1/2" OD x 1/4" wide on 9/32" dia.
	x	Z-302	125-029-101		universal	#36 SSE	66 tapped at 6.5 ±10% from start		40.6 microhenries in air. Resonate at 1955 kc. with 140 mmfd.

TABLE 7-12. WINDING DATA (Continued)

TS-635/UP	TS-318/UP	Symbol Desig.	WIT Part No.	Diagram	Winding	Wire Size	Turns	DC Resis.	Remarks
x		Z-302	21147-1		3 pi sections universal	#34 SSE all secs.	#1-160 tapped at 33 #2 & #3 130T		Meissner Hi Q over coils. Each pi 3/32" wide, spacing 1/8" dia.
x	x	Z-303 304 305 306	125-035-1		universal	5/44 Litz	pri.-400 sec.-520		Coils 7/32" wide, spaced 3/16"
x		Z-307	21140-1		pri. single layer sec. - universal 1/2" wide	#30 SEE #15-44 Litz	35 378		Meissner Hi Q over coils. Sec. #1-#2 wound over pri. #3-#4 separated by 2 layers elect. tape.
	x	AS-377/U	Loop 4265-1 Pedestal 3827-1			#26E	6T		
x		AS-400/UP	Loop 4265-36 Pedestal 3827-1			#26E	12T		

e. DRAWINGS.

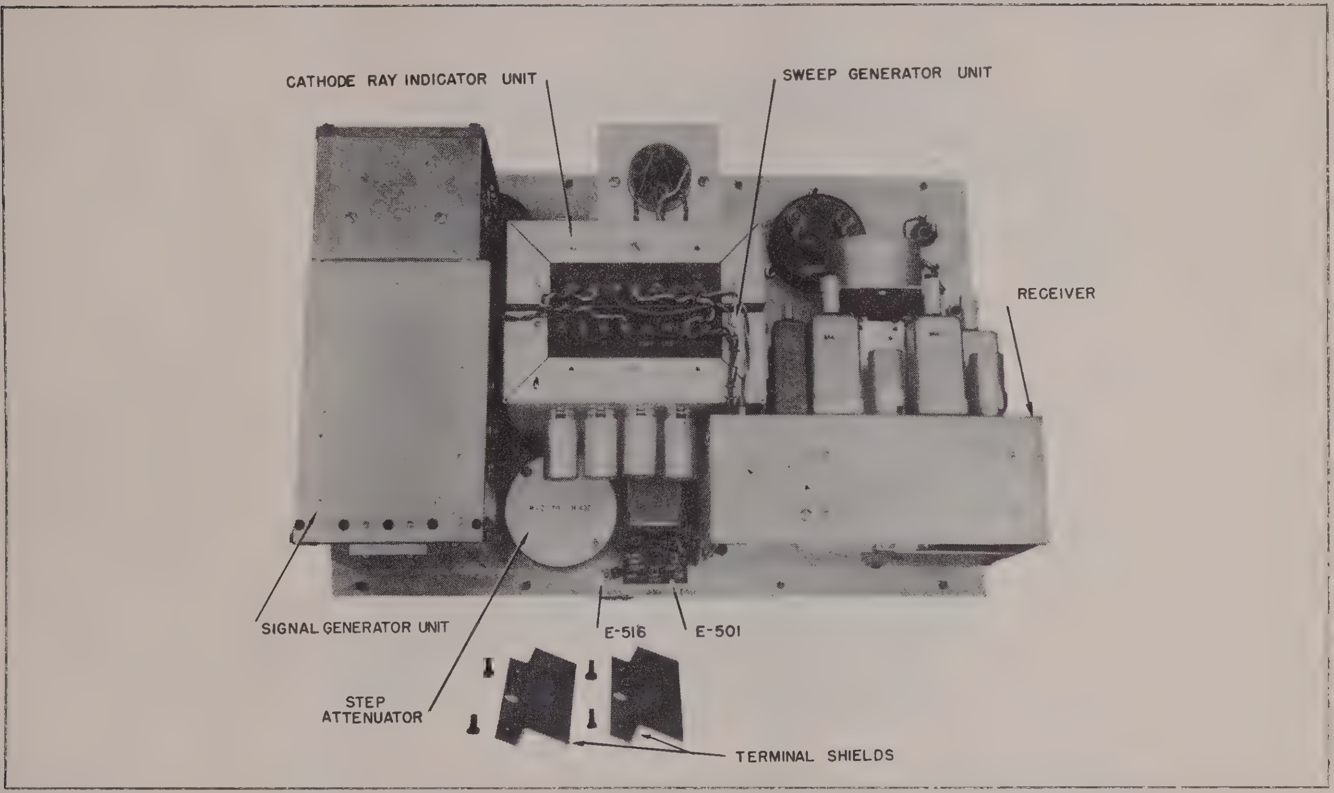


Figure 7–13. Field Intensity Meter IM–10/UP or IM–14/UP, Case Removed, Units in Place

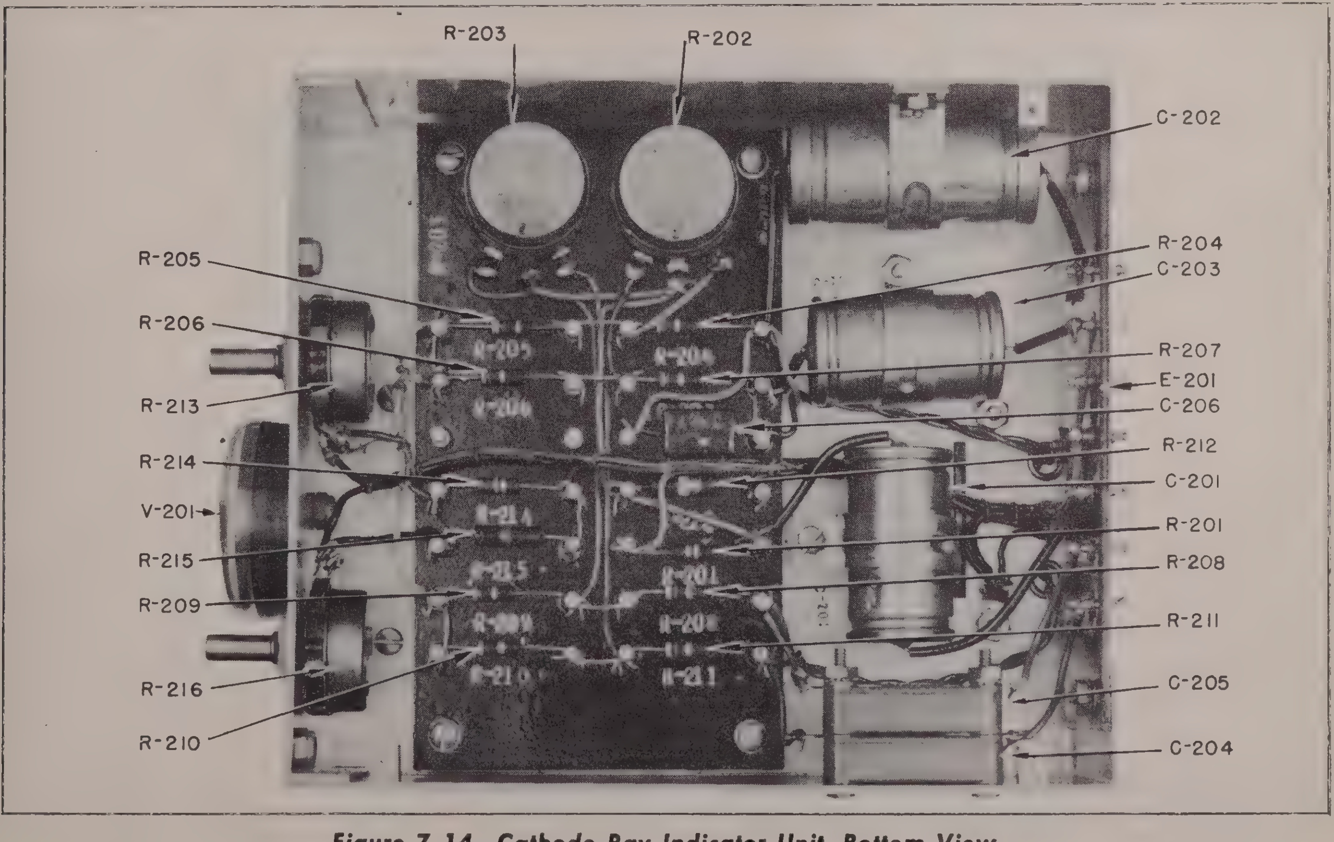


Figure 7–14. Cathode Ray Indicator Unit, Bottom View

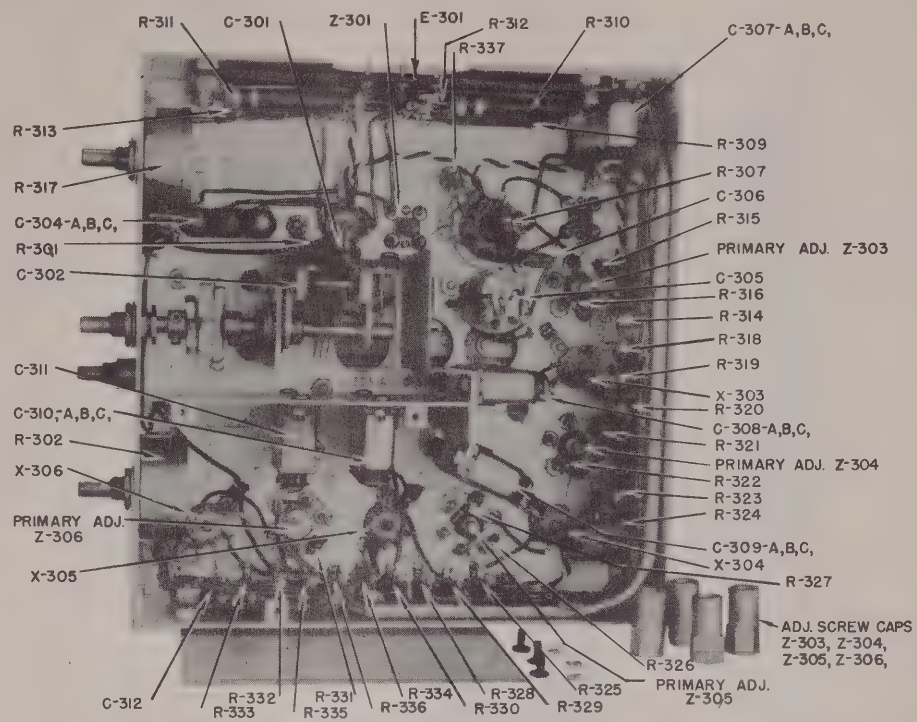


Figure 7–15. Receiver, IM–10/UP, Bottom View

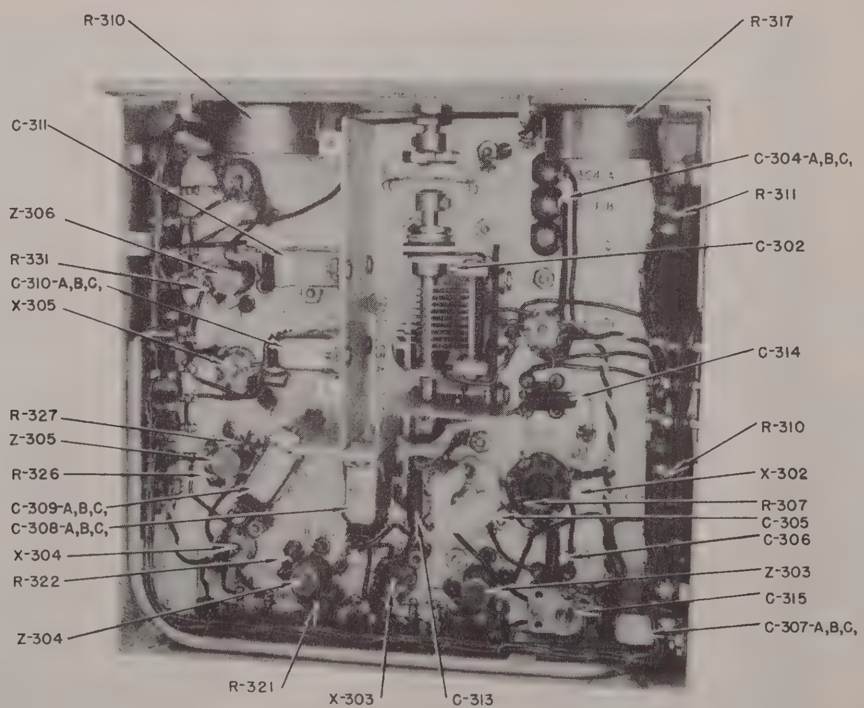


Figure 7–16. Receiver, IM–14/UP, Bottom View

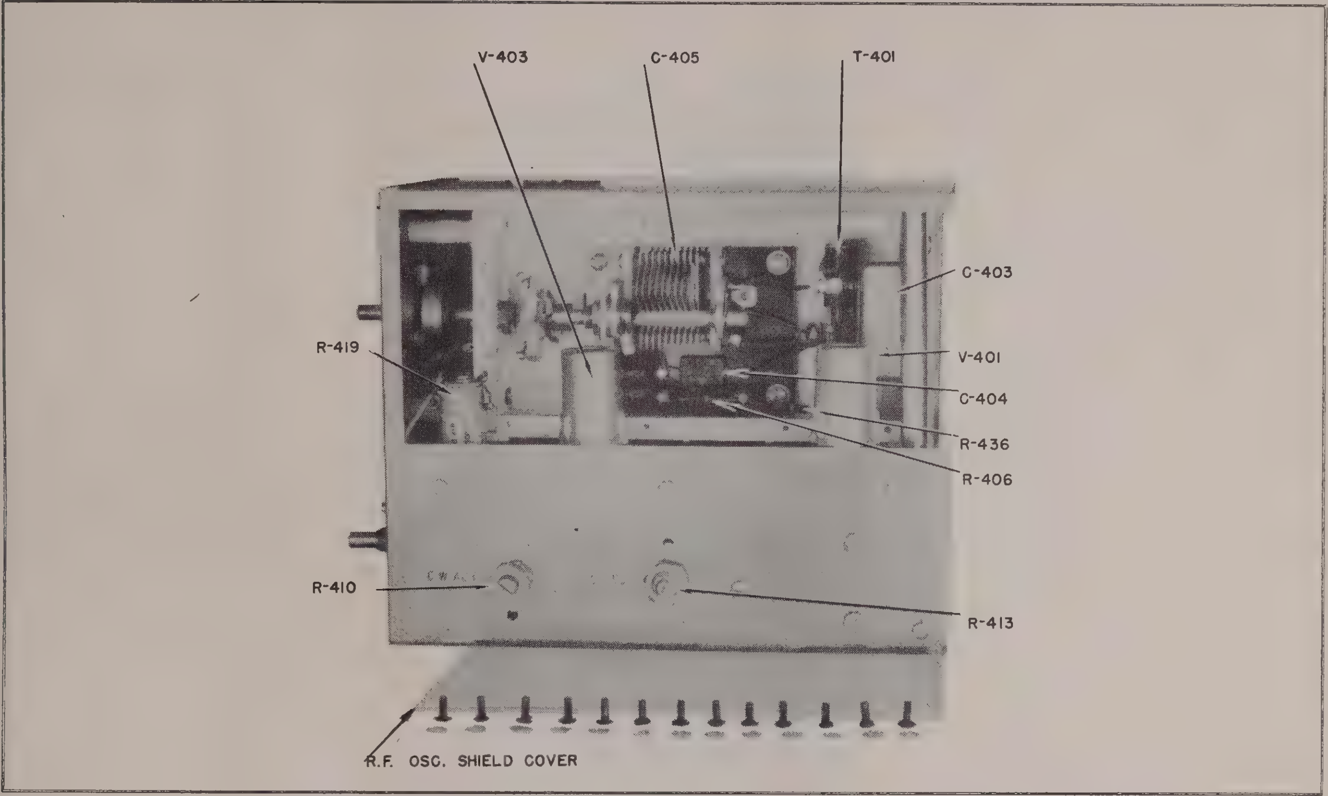


Figure 7-17. Signal Generator Unit, IM-10/UP, Side View, Covers Removed

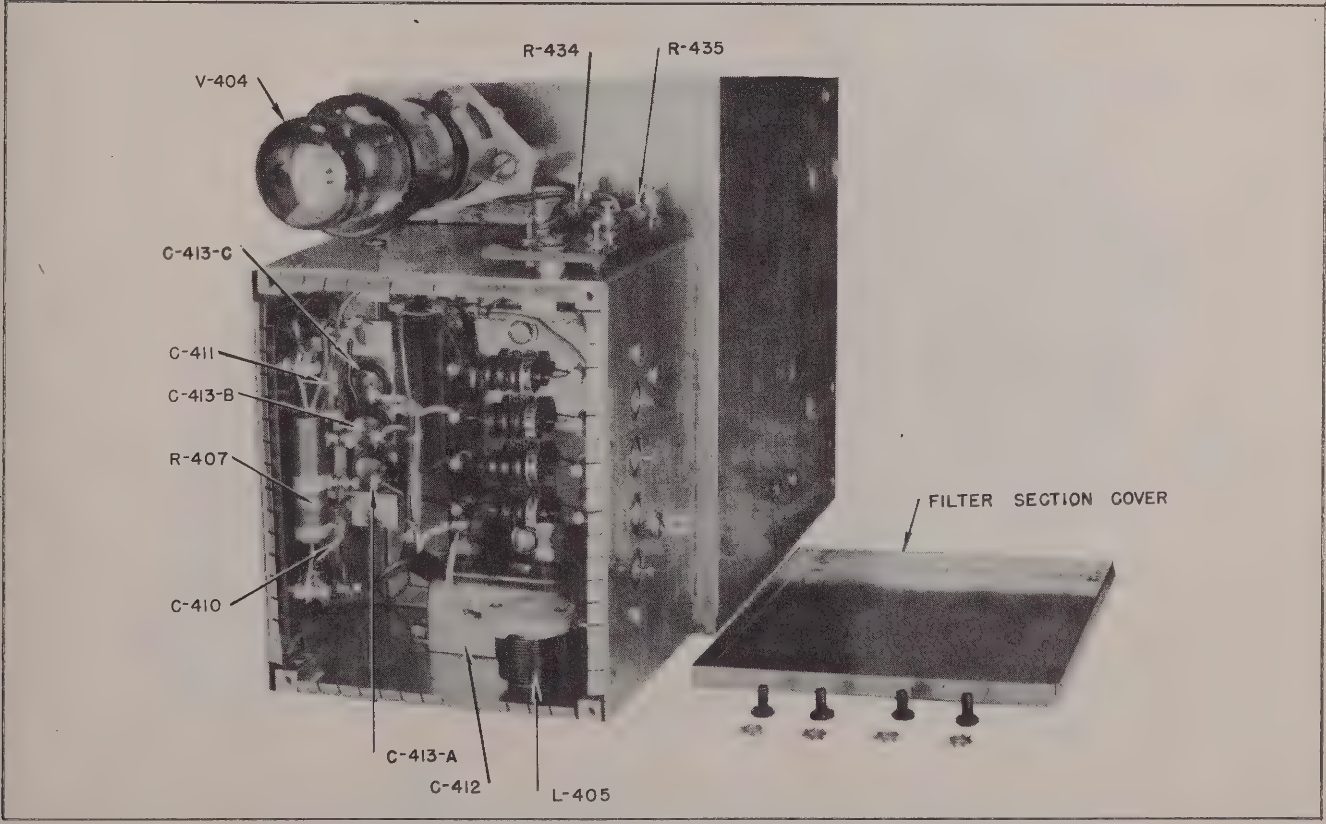


Figure 7-18. Signal Generator Unit, Top View, Filter Cover Removed

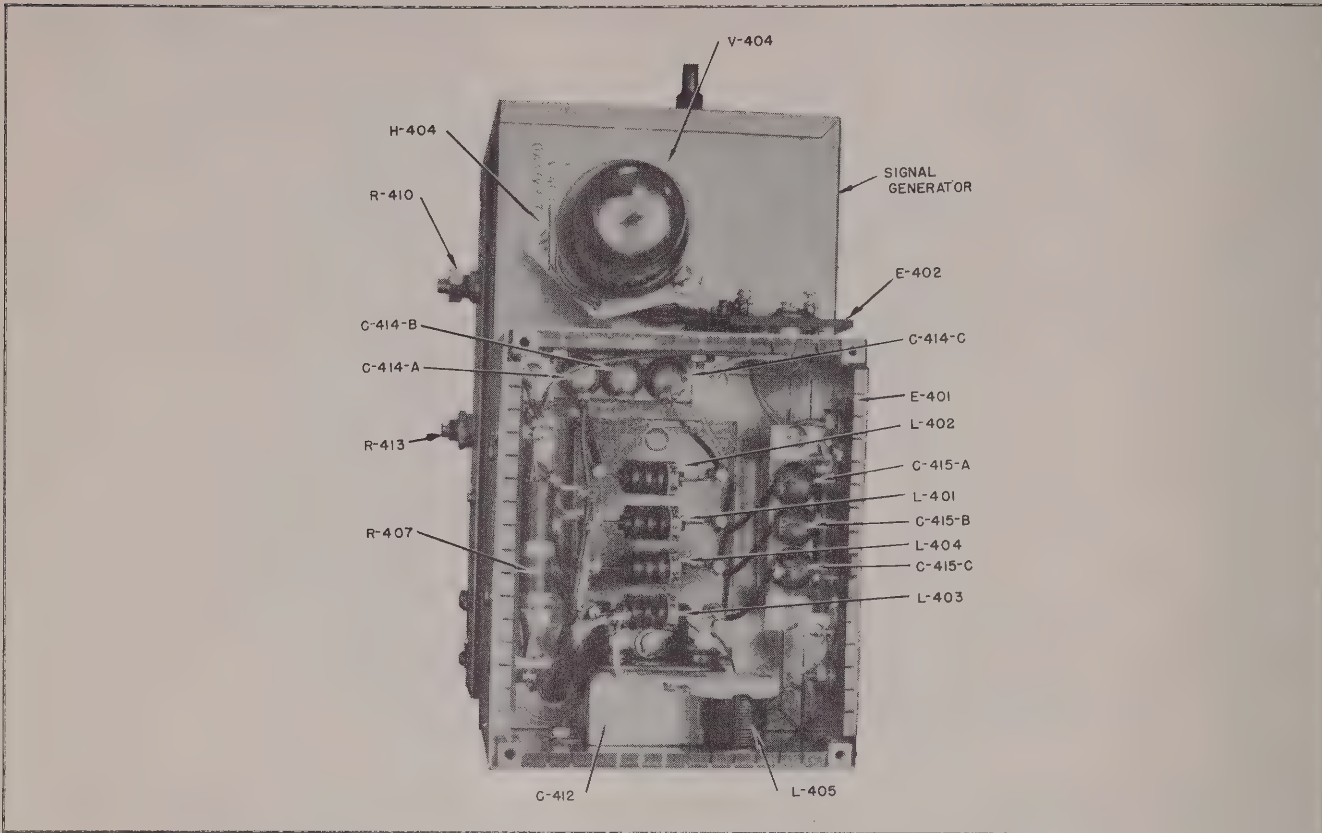


Figure 7–19. Signal Generator Unit, Top View, Filter Cover Removed

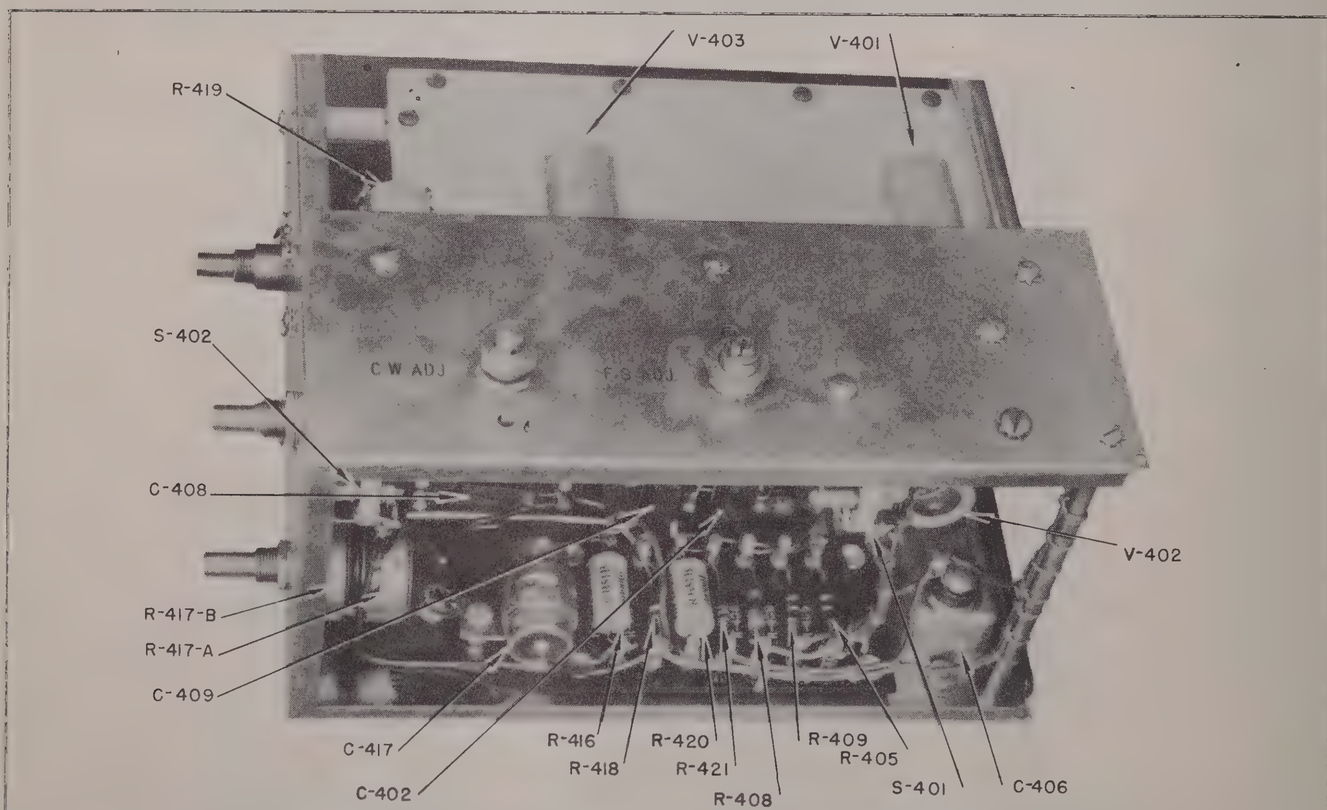


Figure 7–20. Signal Generator Unit, Bottom View, Left Underside of Chassis

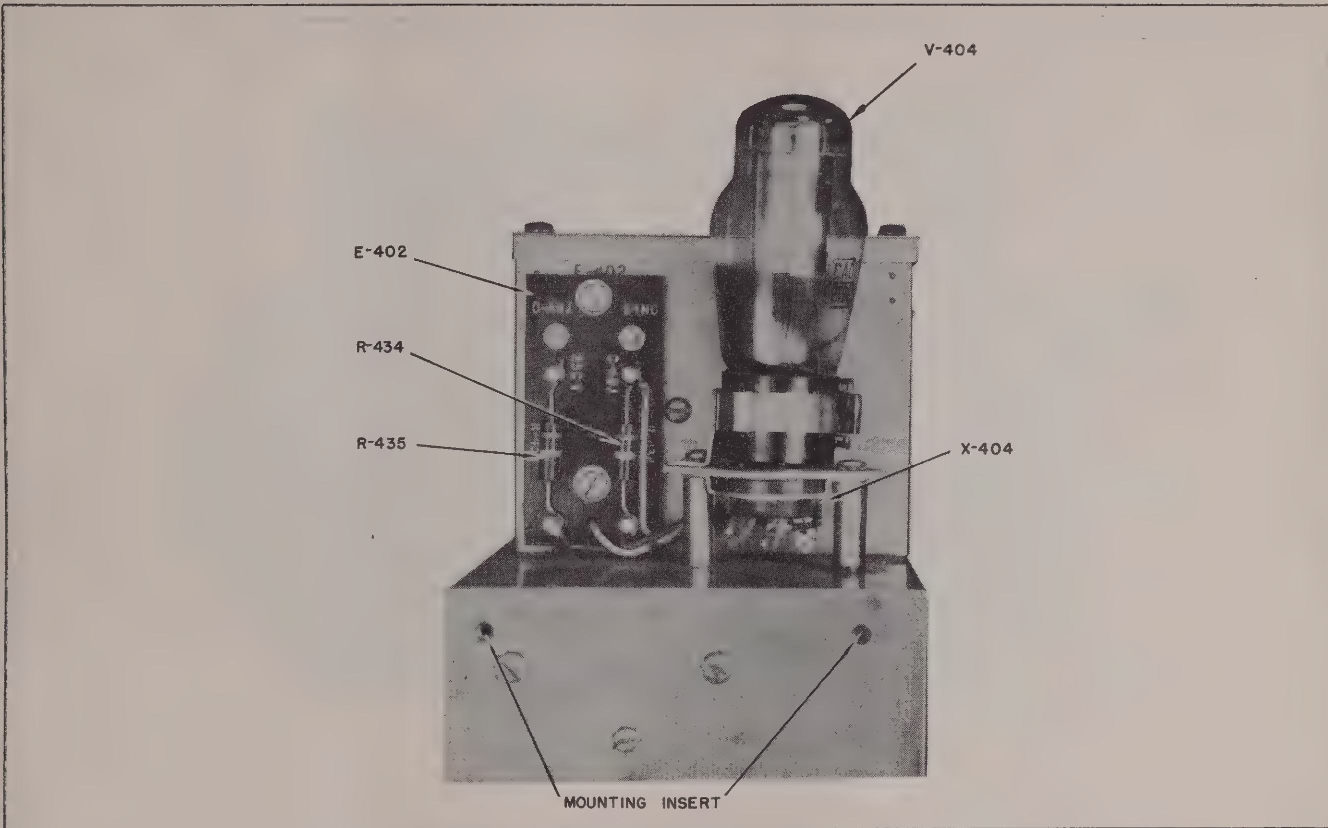


Figure 7–21. Signal Generator Unit, End View Showing E–402

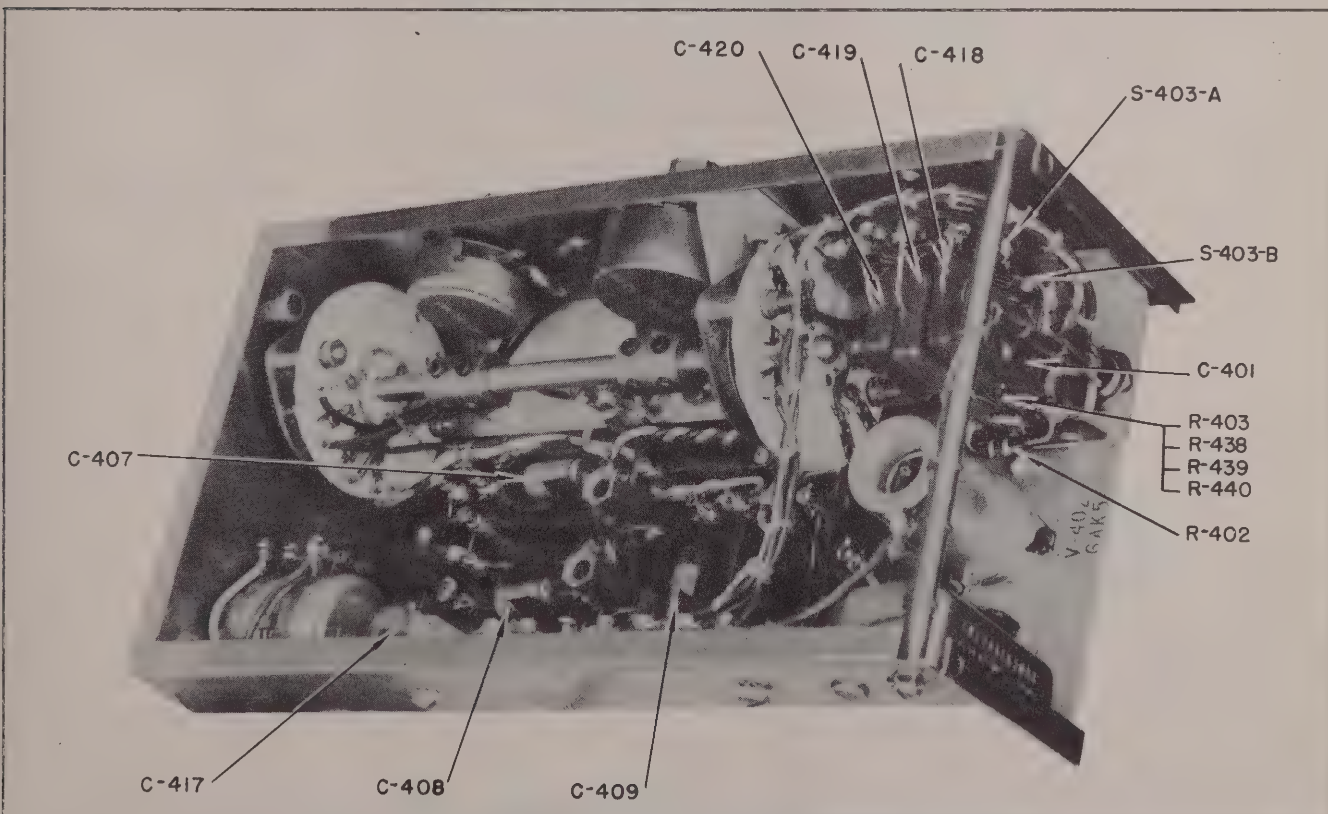


Figure 7–22. Signal Generator Unit, IM–14/UP, Bottom View of S–403

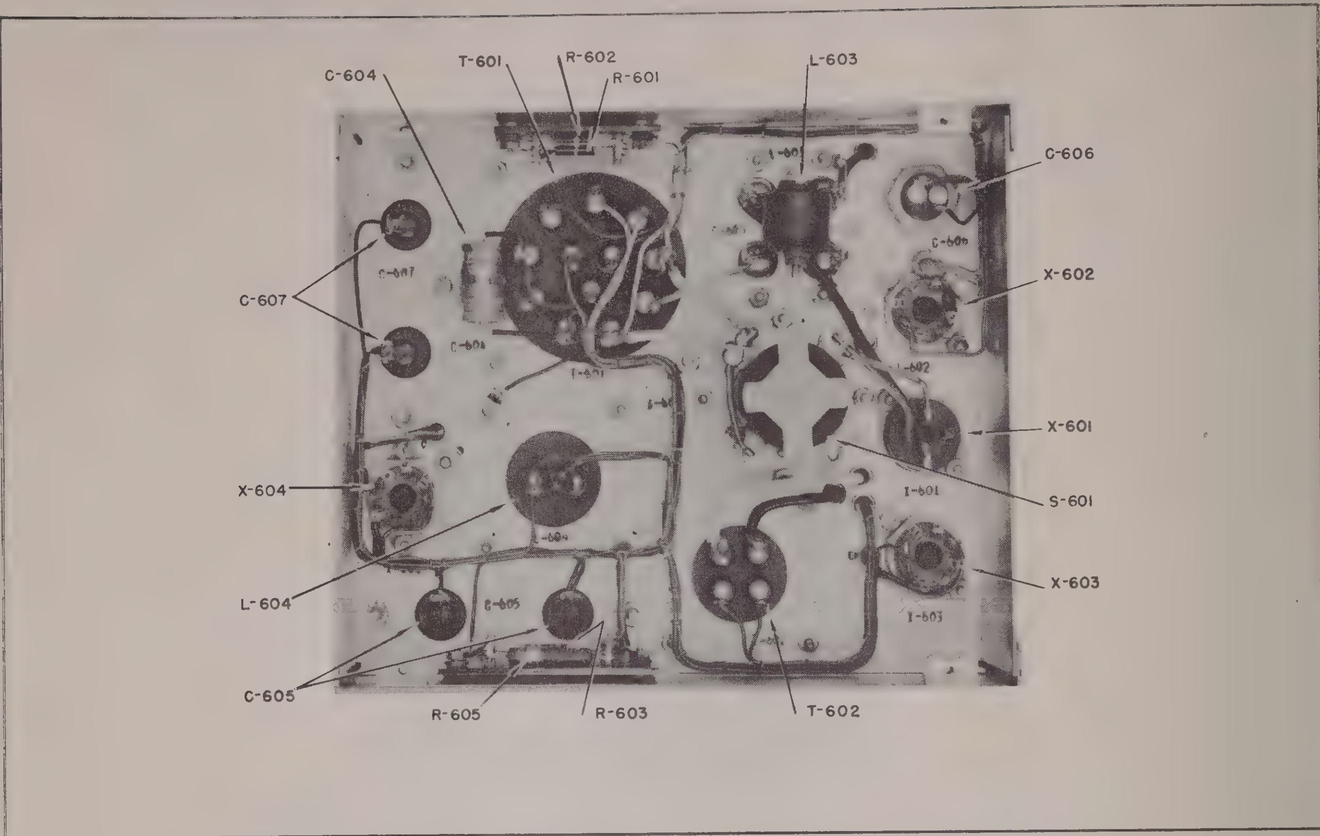


Figure 7–23. Power Supply PP–287/U, Bottom View

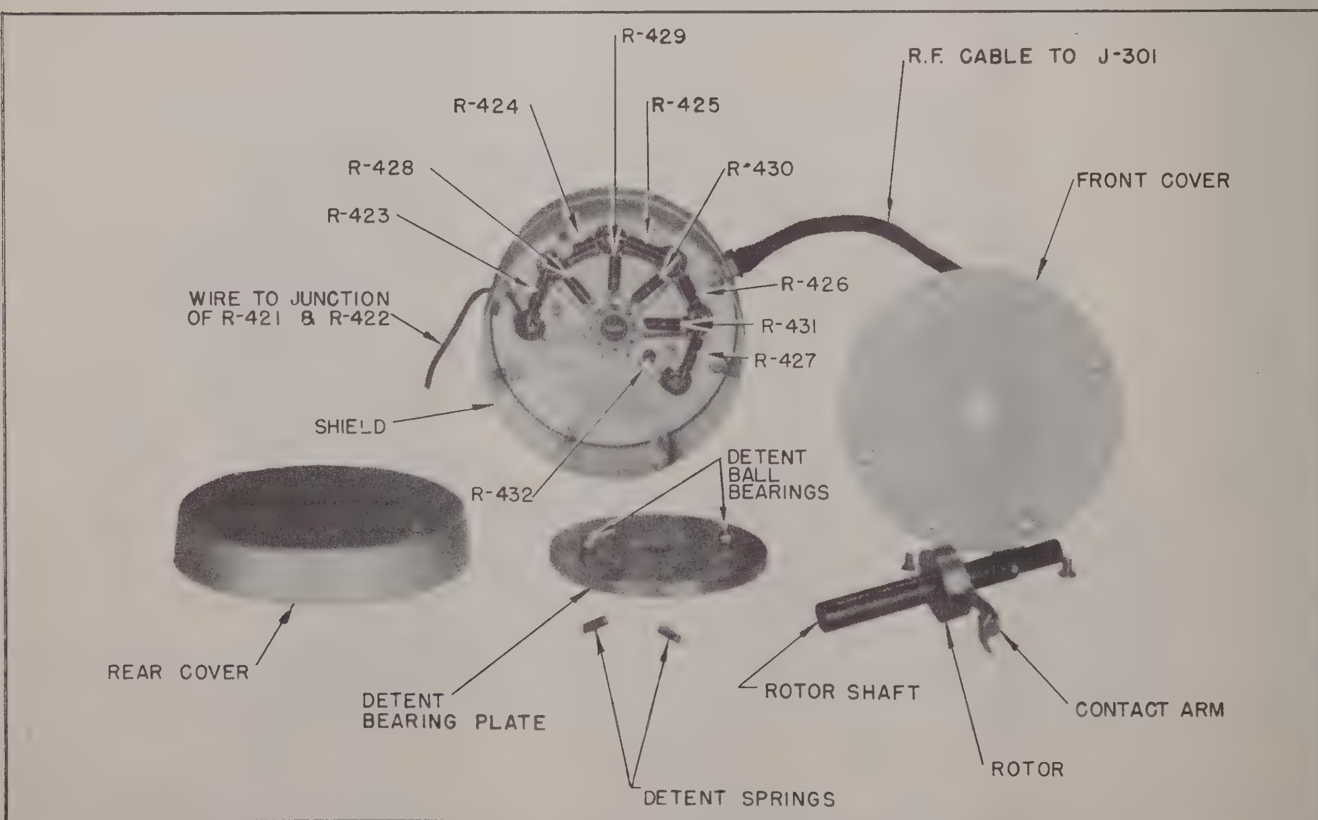


Figure 7–24. Step Attenuator, Rear View, Cover Removed

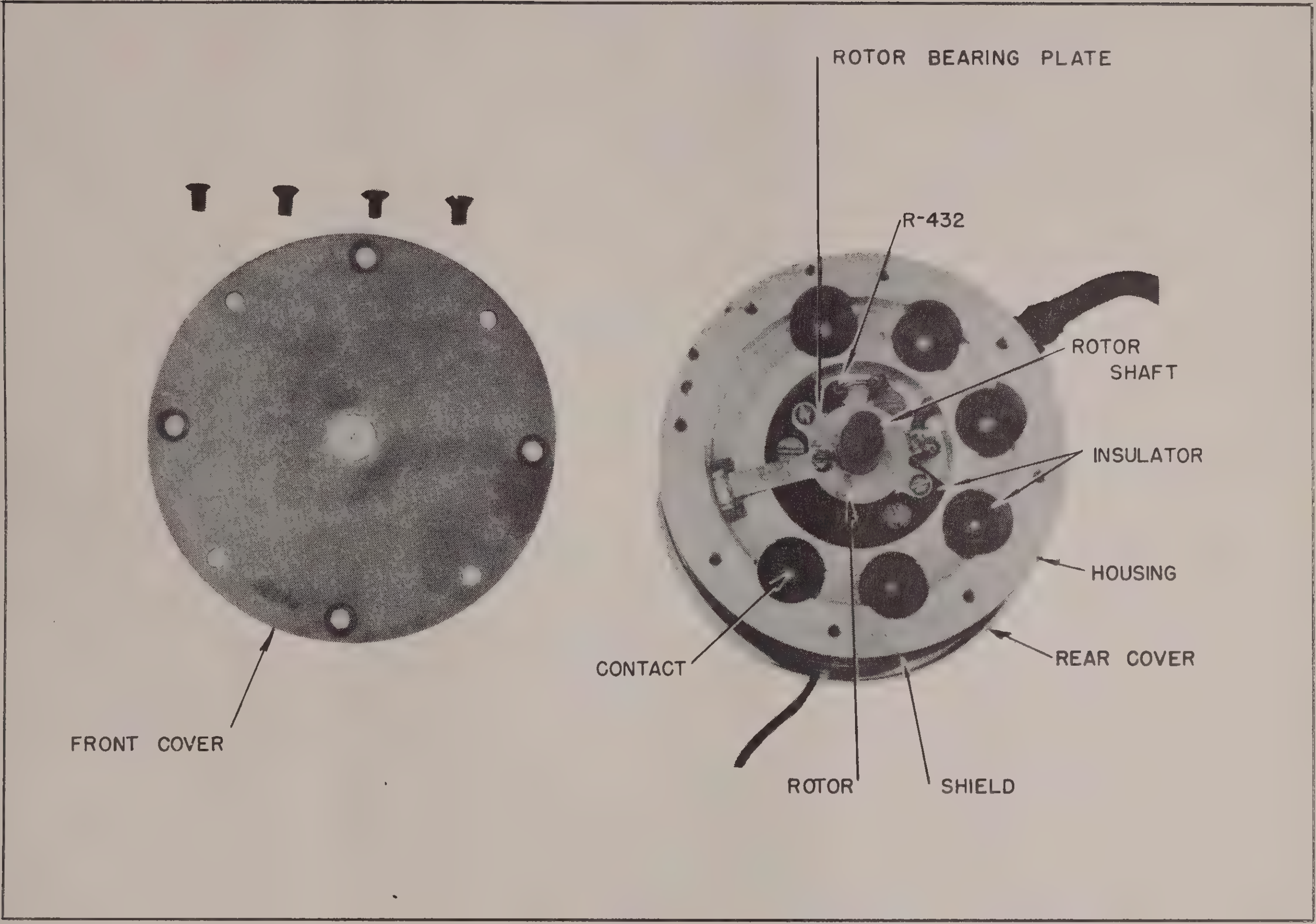


Figure 7–25. Step Attenuator, Front View, Cover Removed

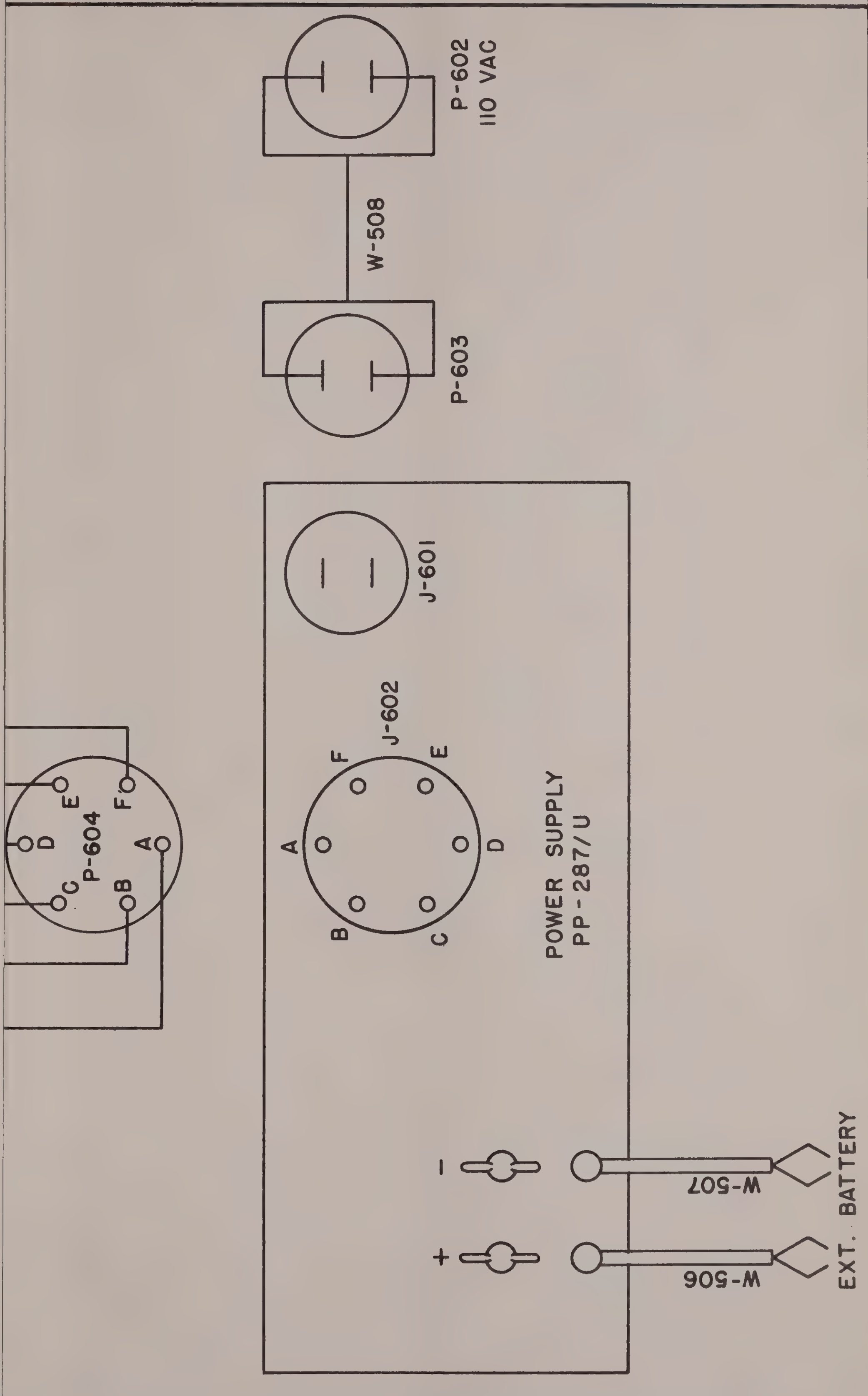


Figure 7–26. Inter-connection Diagram, Field Intensity Meter TS–318/UP or TS–635/UP

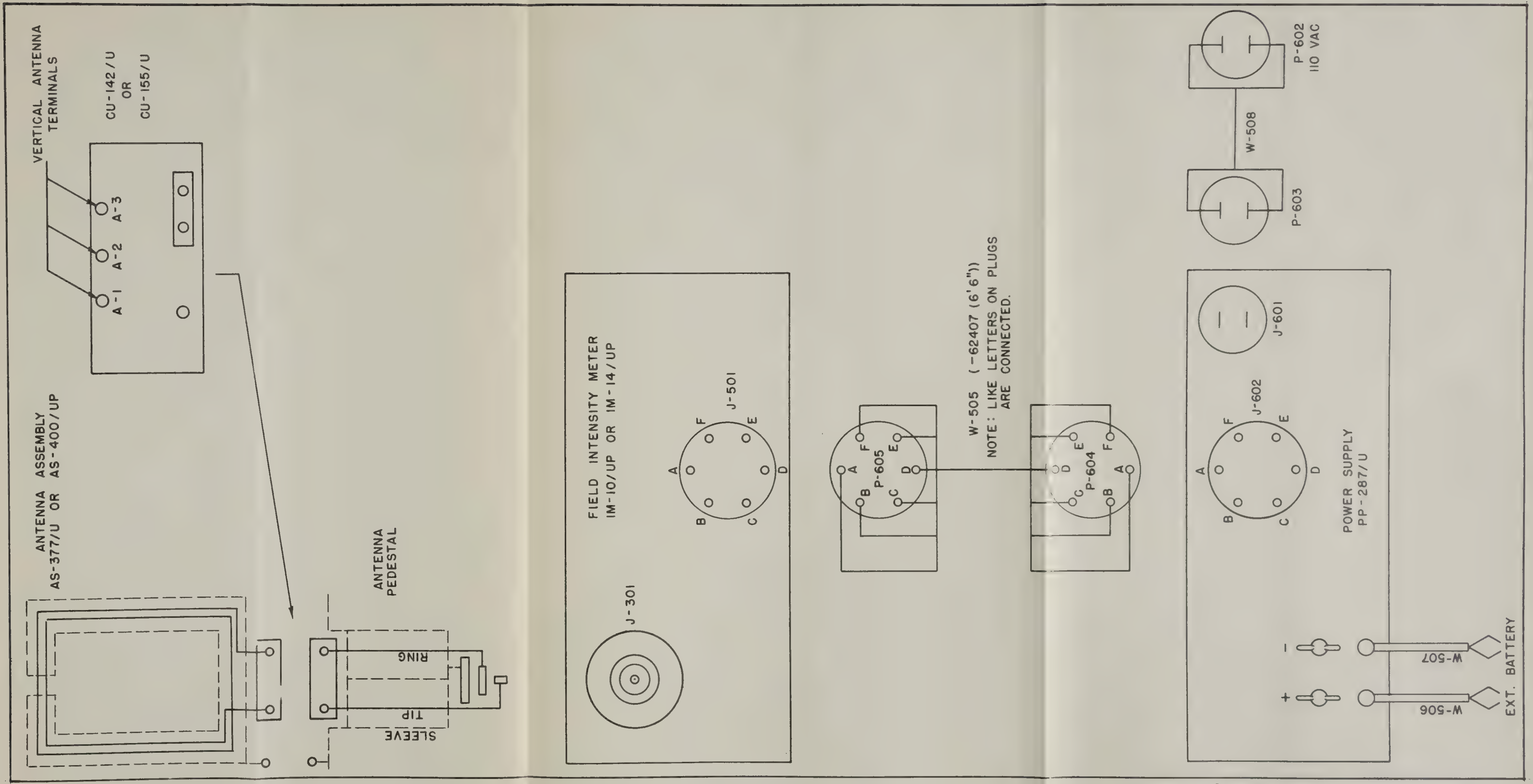


Figure 7–26. Inter-connection Diagram, Field Intensity Meter TS–318/UP or TS–635/UP

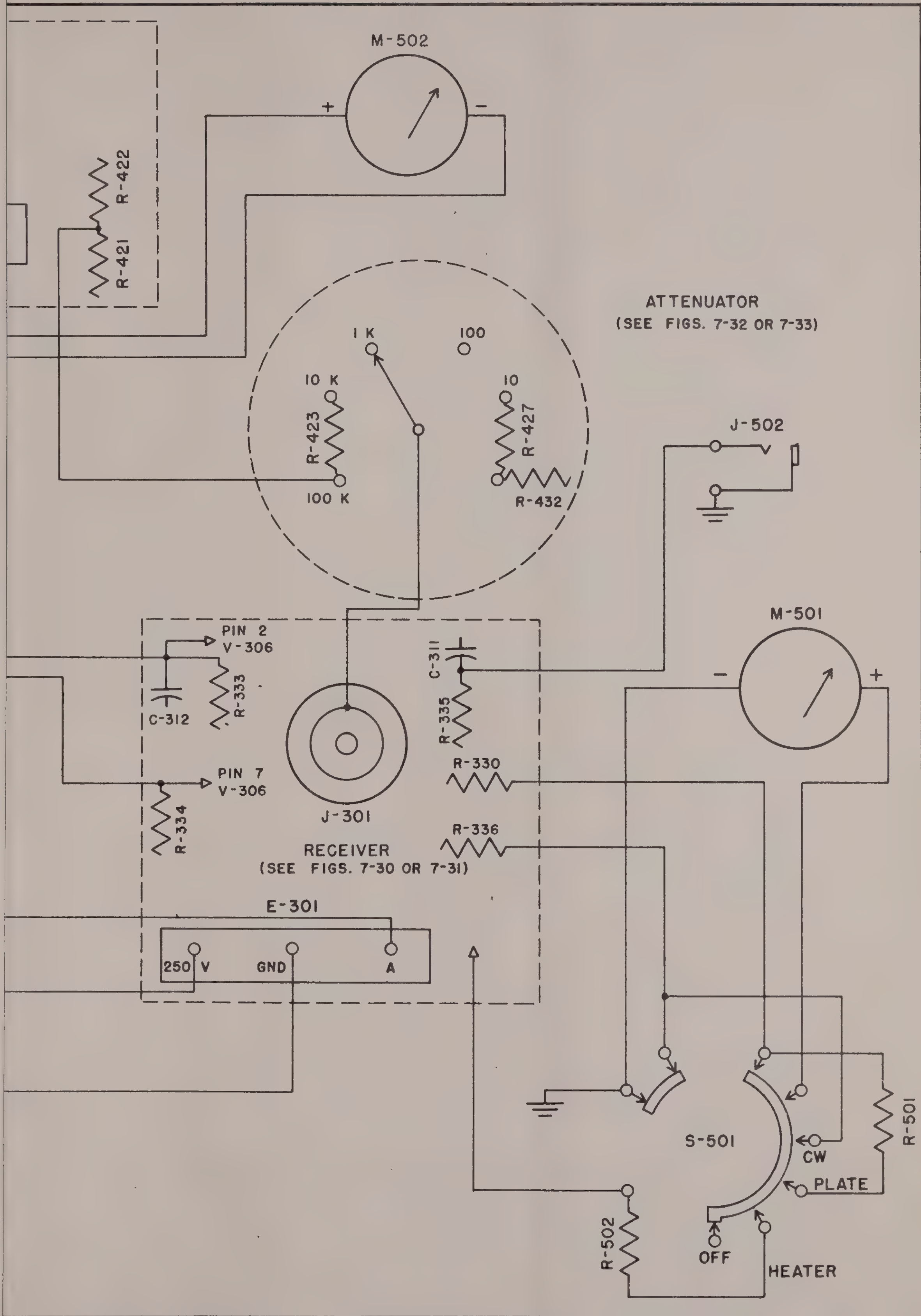


Figure 7–27. Schematic, Field Intensity Meter TS–318/UP or TS–635/UP

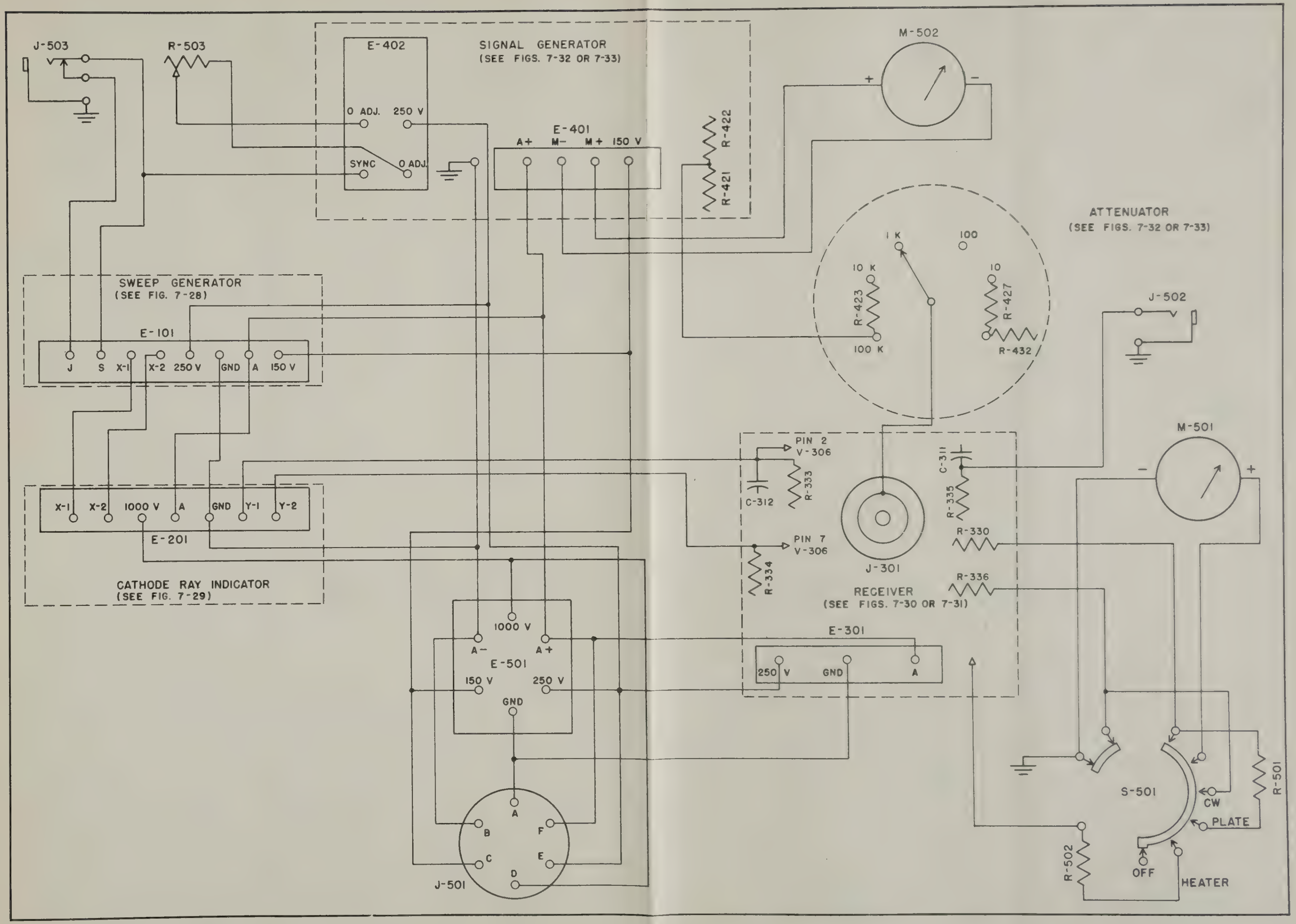


Figure 7–27. Schematic, Field Intensity Meter TS–318/UP or TS–635/UP

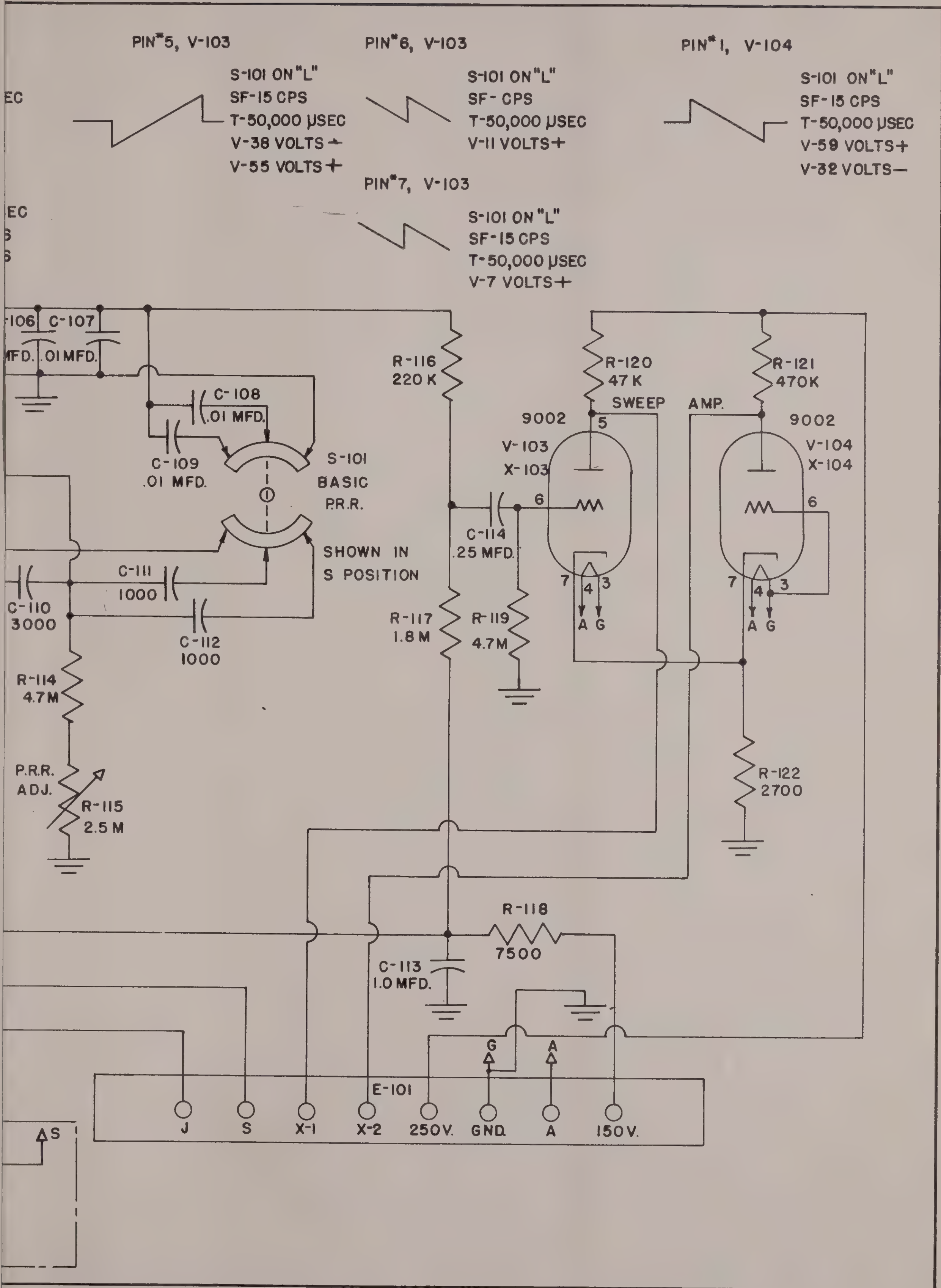


Figure 7–28. Schematic, Sweep Generator Unit

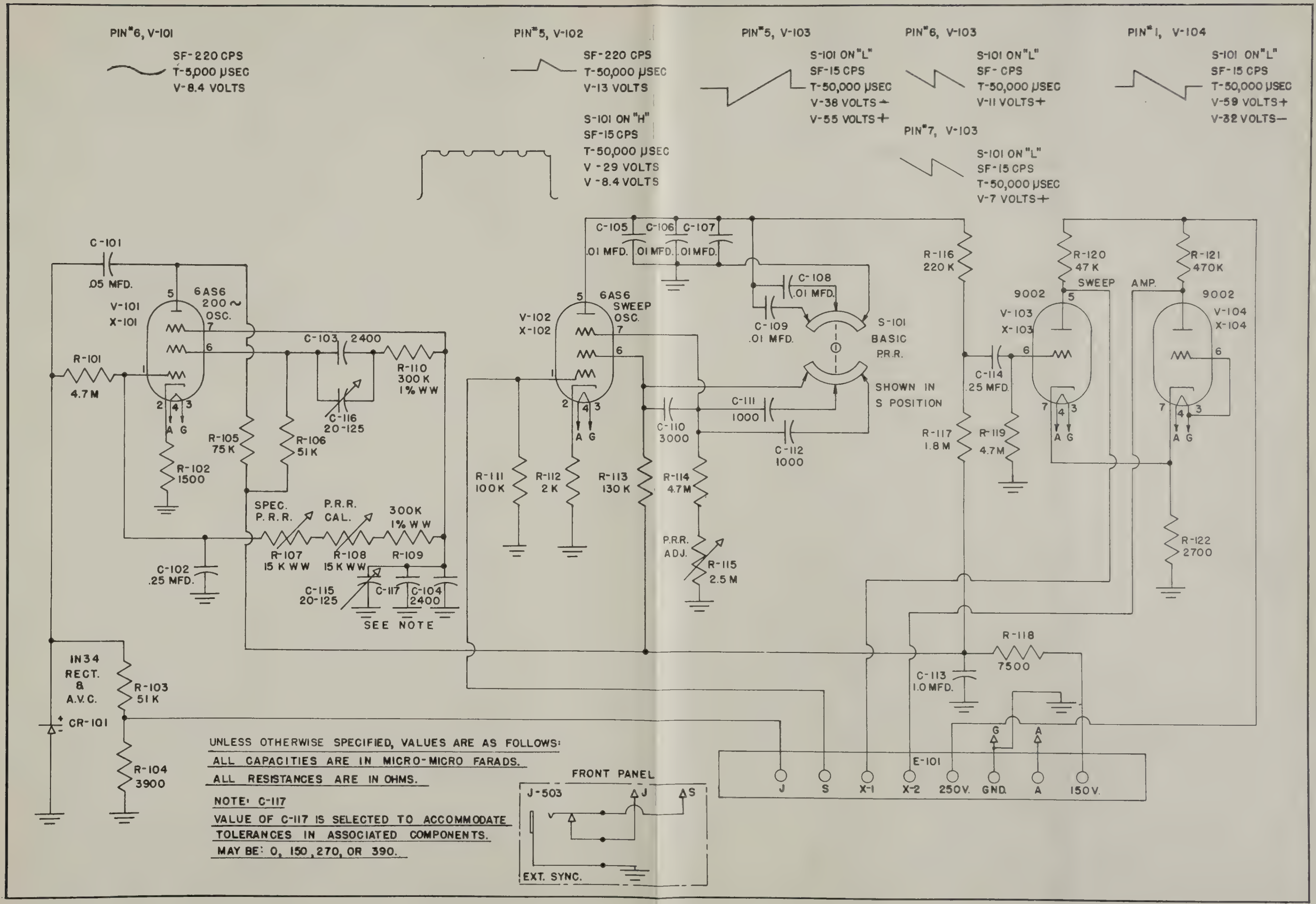


Figure 7–28. Schematic, Sweep Generator Unit

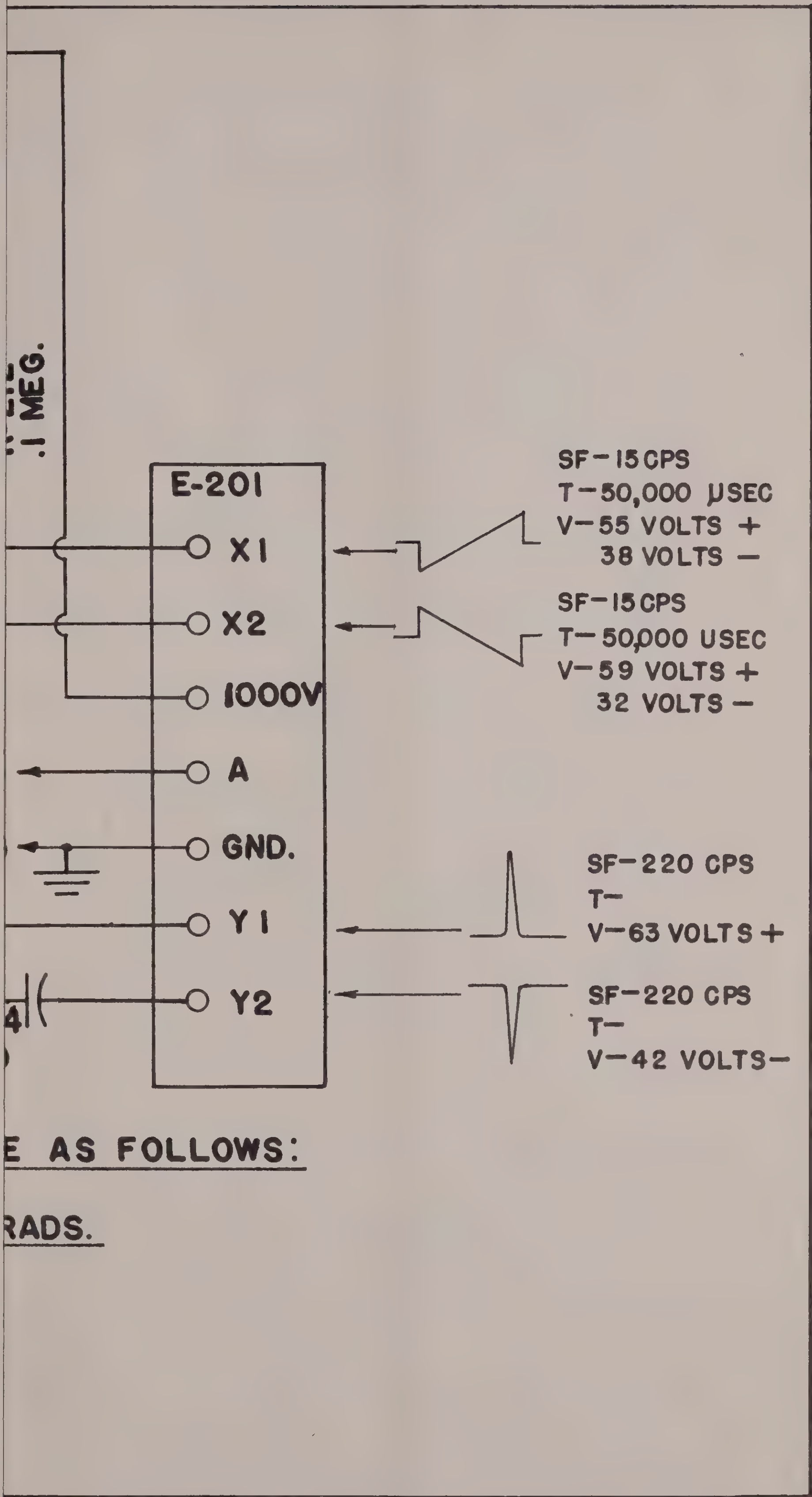


Figure 7-29. Schematic, Cathode Ray Indicator Unit

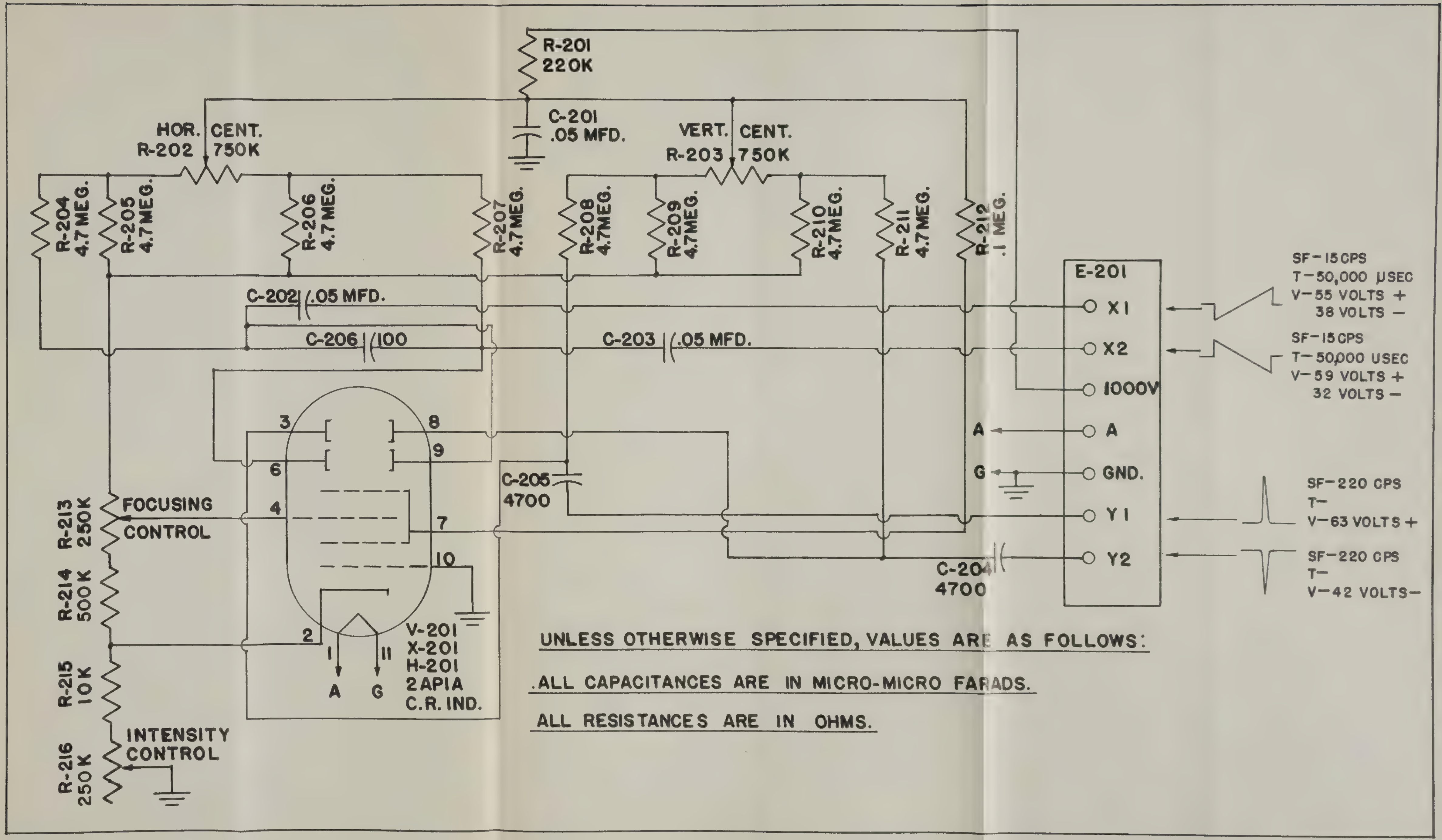


Figure 7-29. Schematic, Cathode Ray Indicator Unit

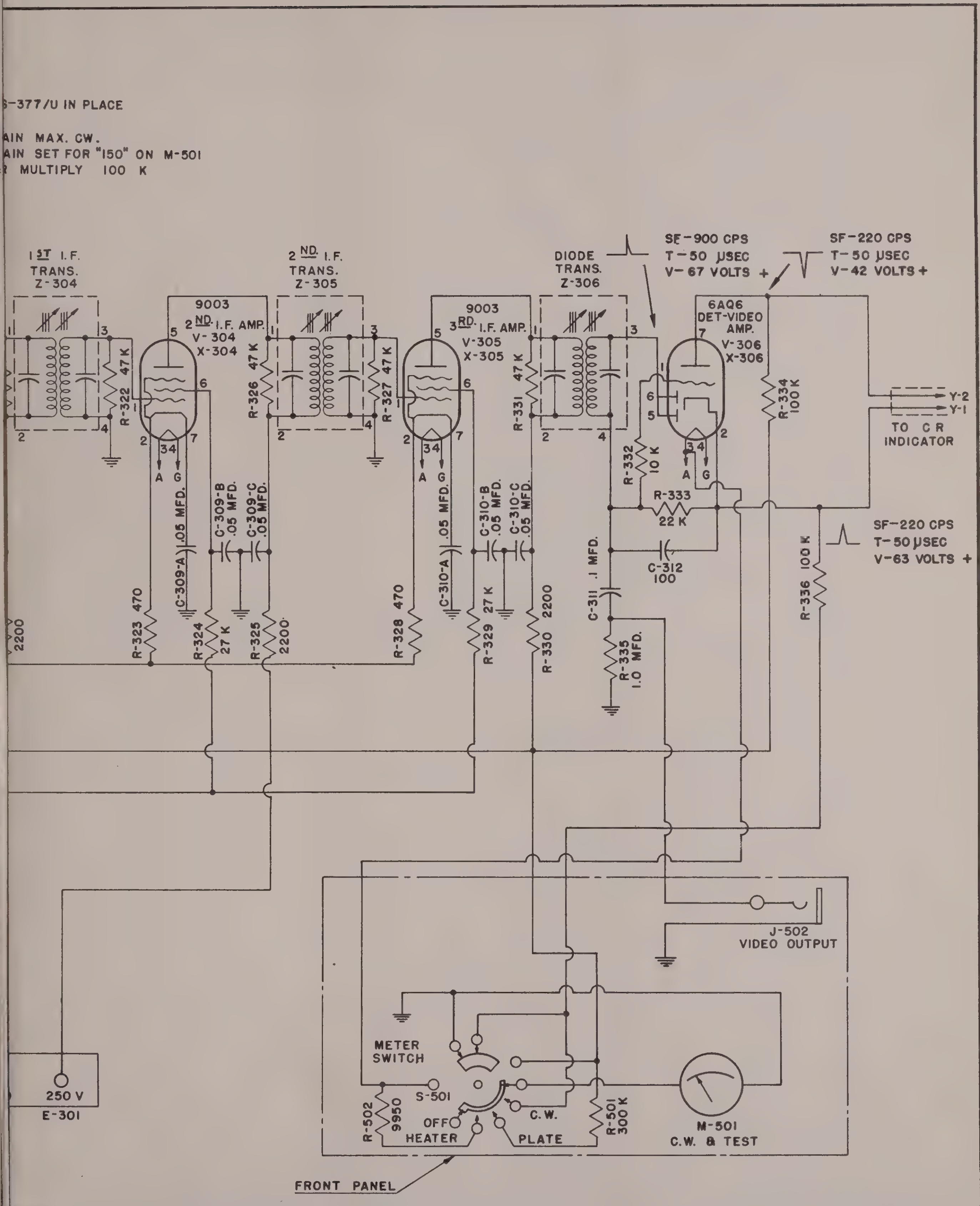


Figure 7–30. Schematic, Receiver, IM–10/UP

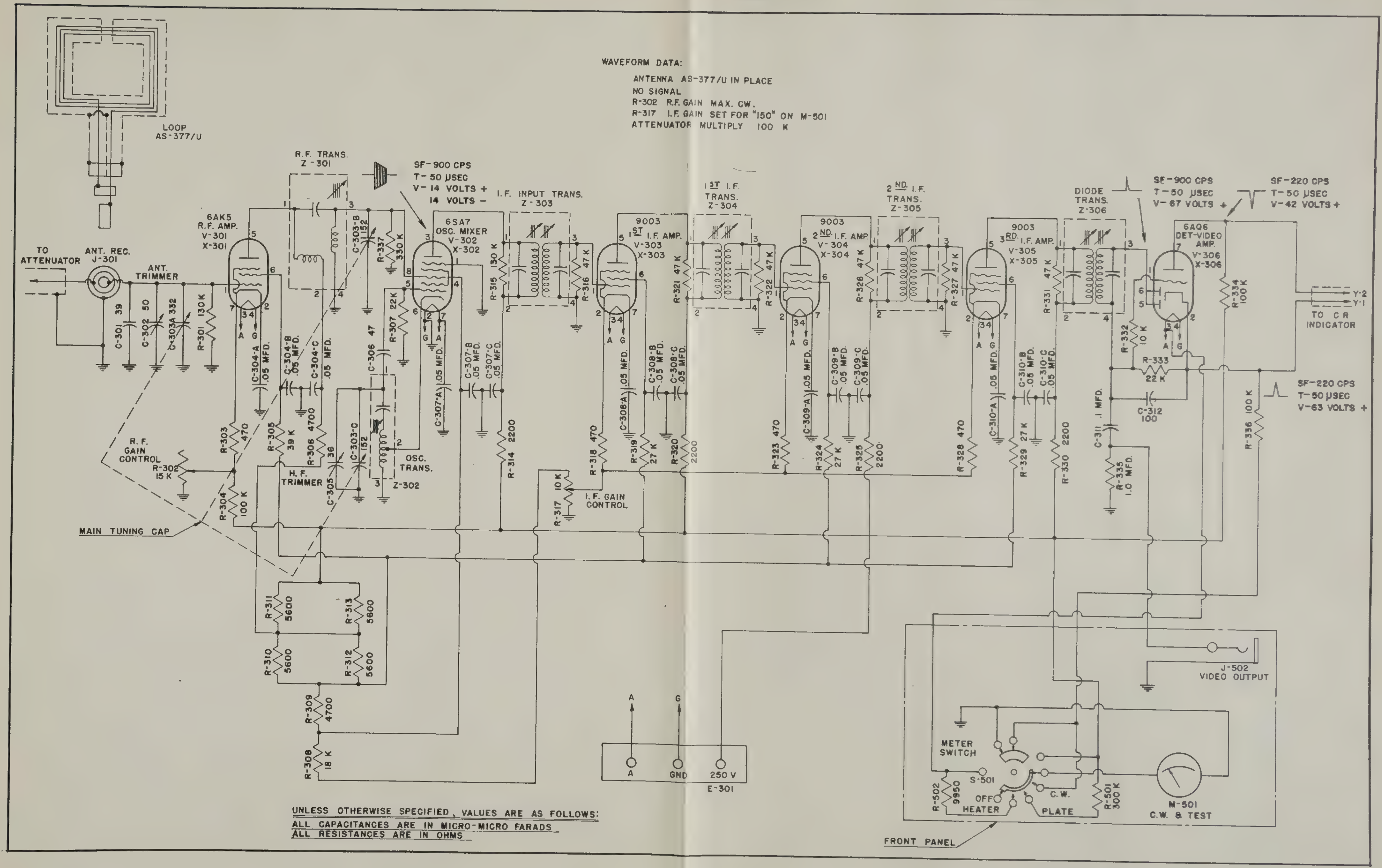


Figure 7-30. Schematic, Receiver, IM-10/UP

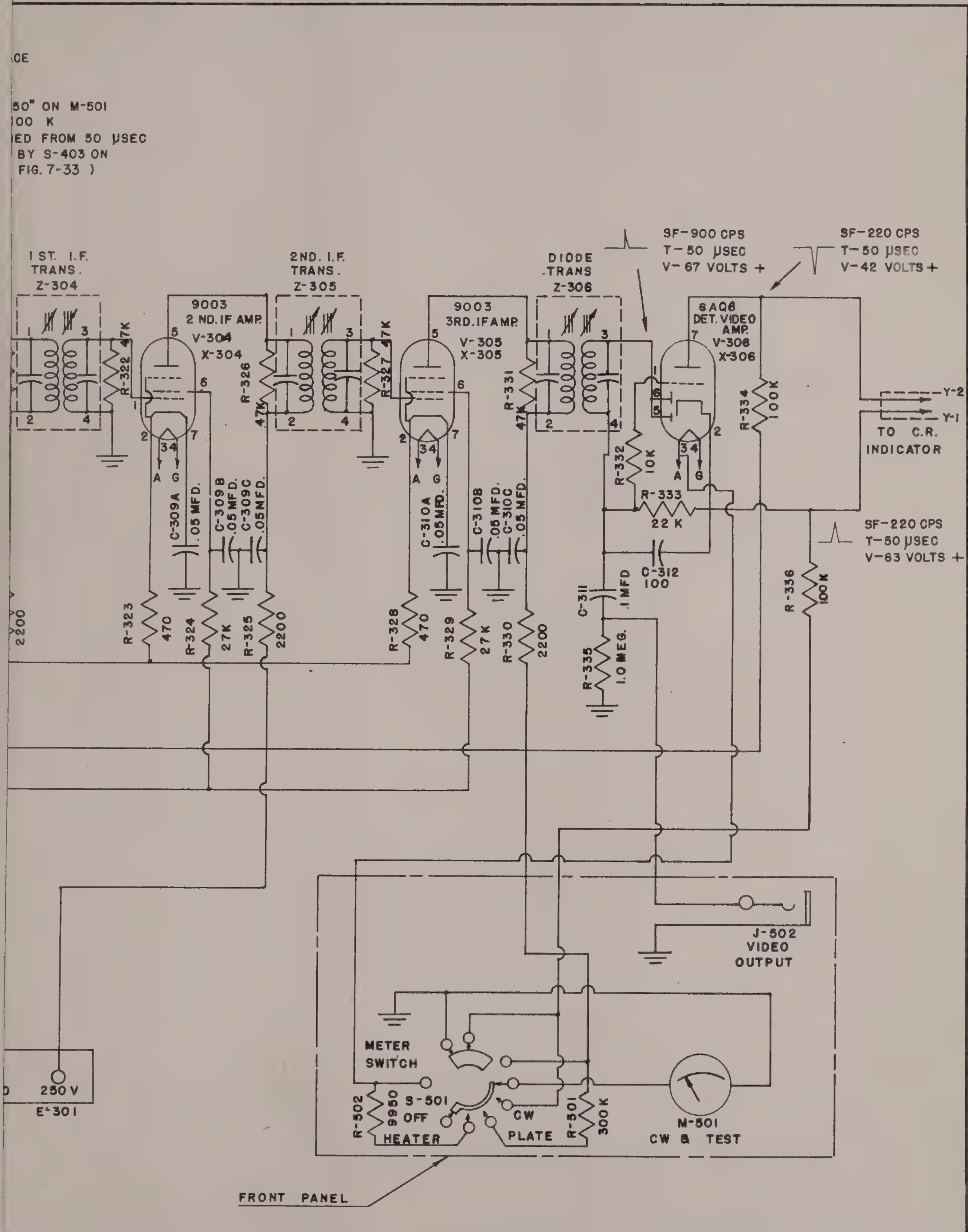


Figure 7–31. Schematic, Receiver, IM–14/UP

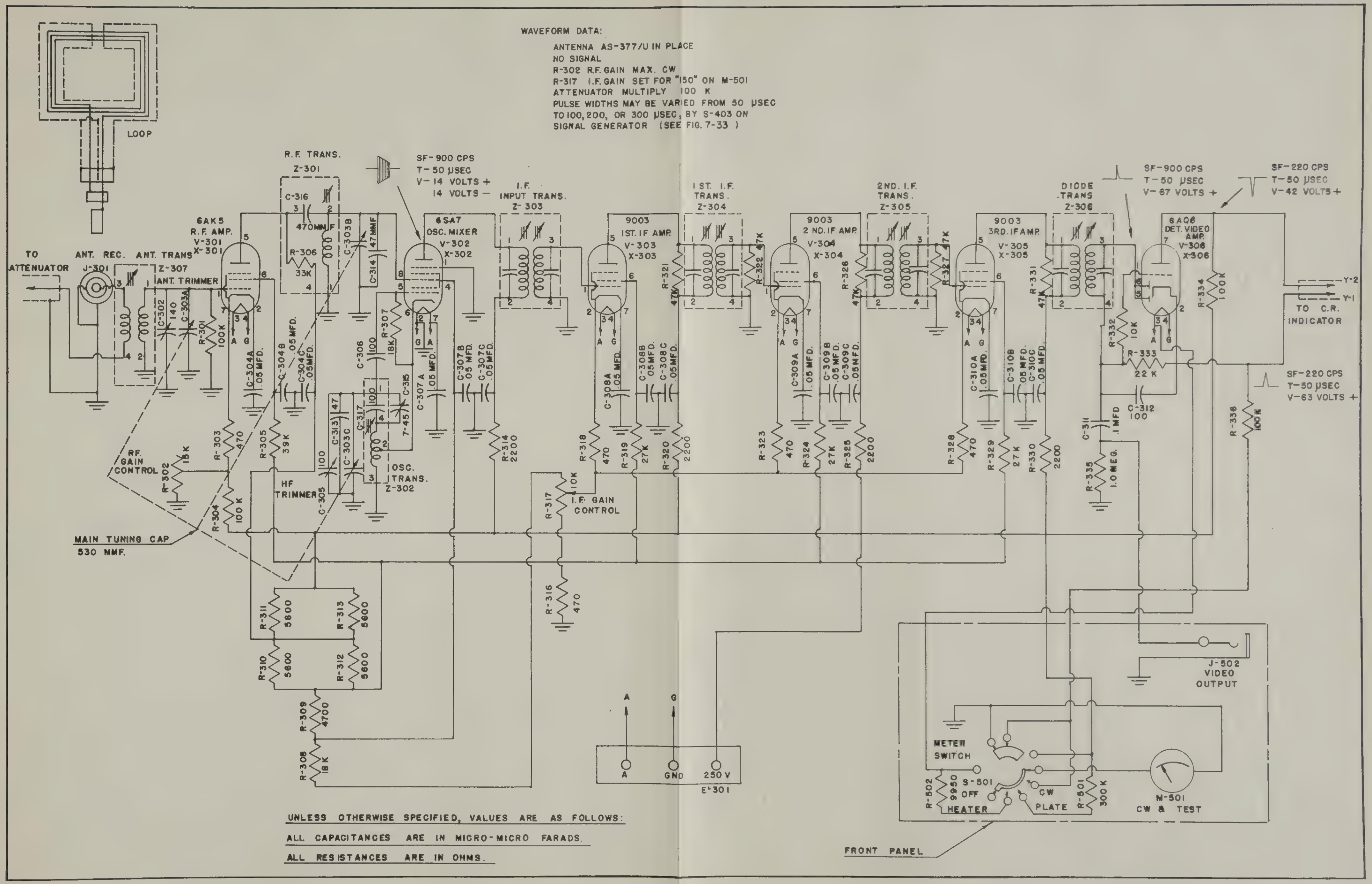


Figure 7-31. Schematic, Receiver, IM-14/UP

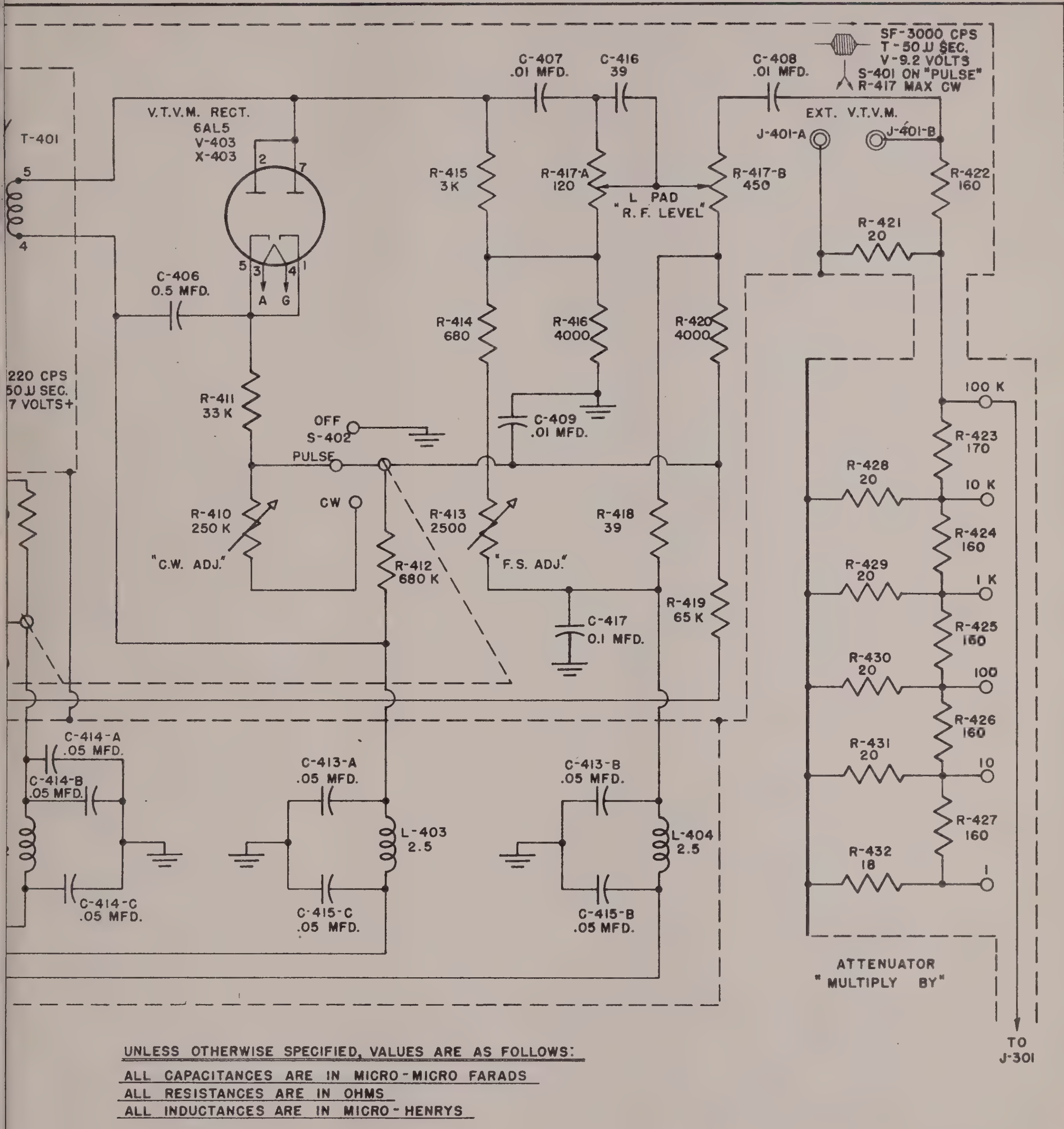


Figure 7–32. Schematic, Signal Generator Unit, IM–10/UP

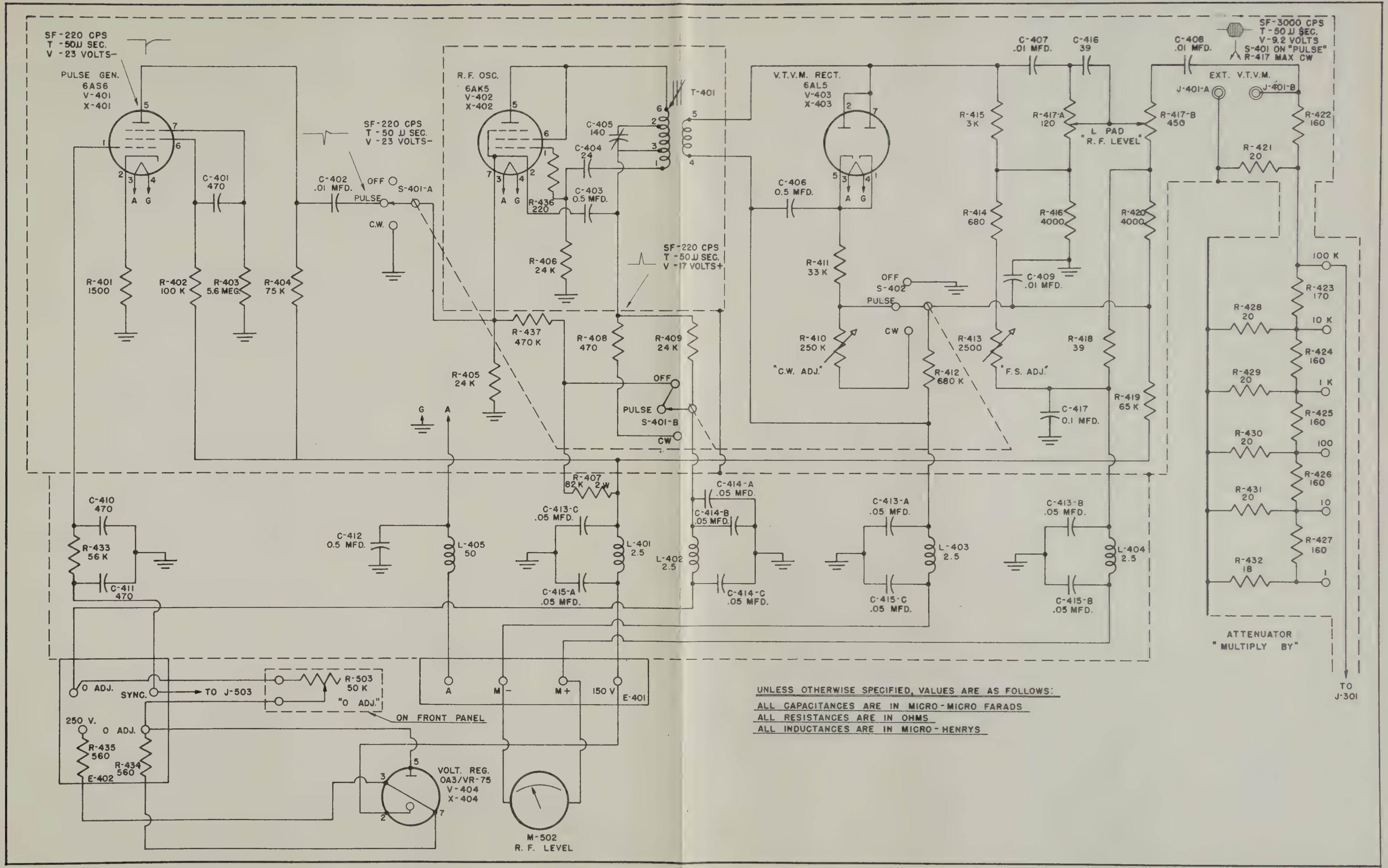
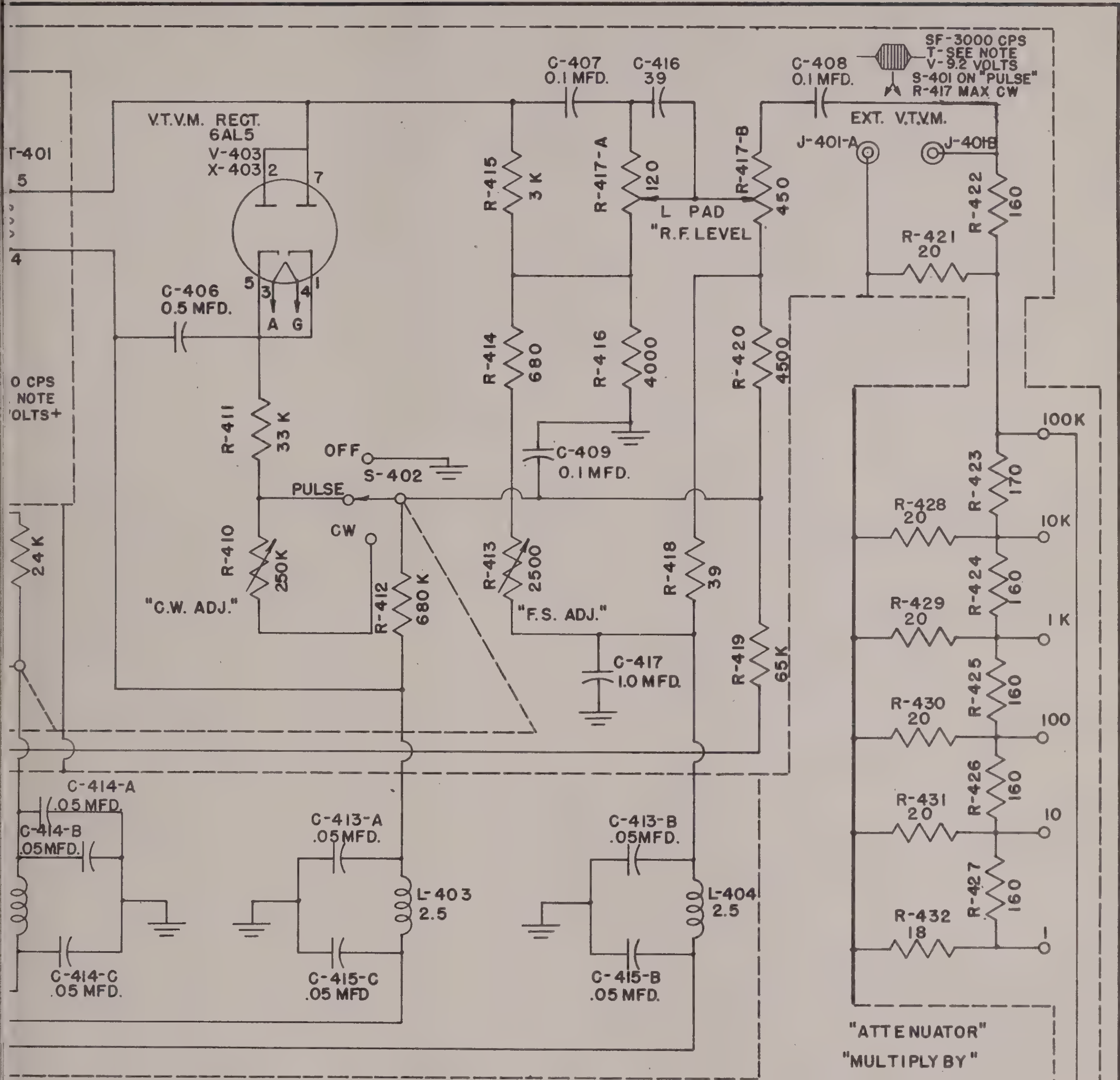


Figure 7–32. Schematic, Signal Generator Unit, IM-10/UP



UNLESS OTHERWISE SPECIFIED, VALUES ARE AS FOLLOWS:

ALL CAPACITANCES ARE IN MICRO-MICRO FARADS.

ALL RESISTANCES ARE IN OHMS.

ALL INDUCTANCES ARE IN MILLI-HENRYS

Figure 7-33. Schematic, Signal Generator Unit, IM-14/UP

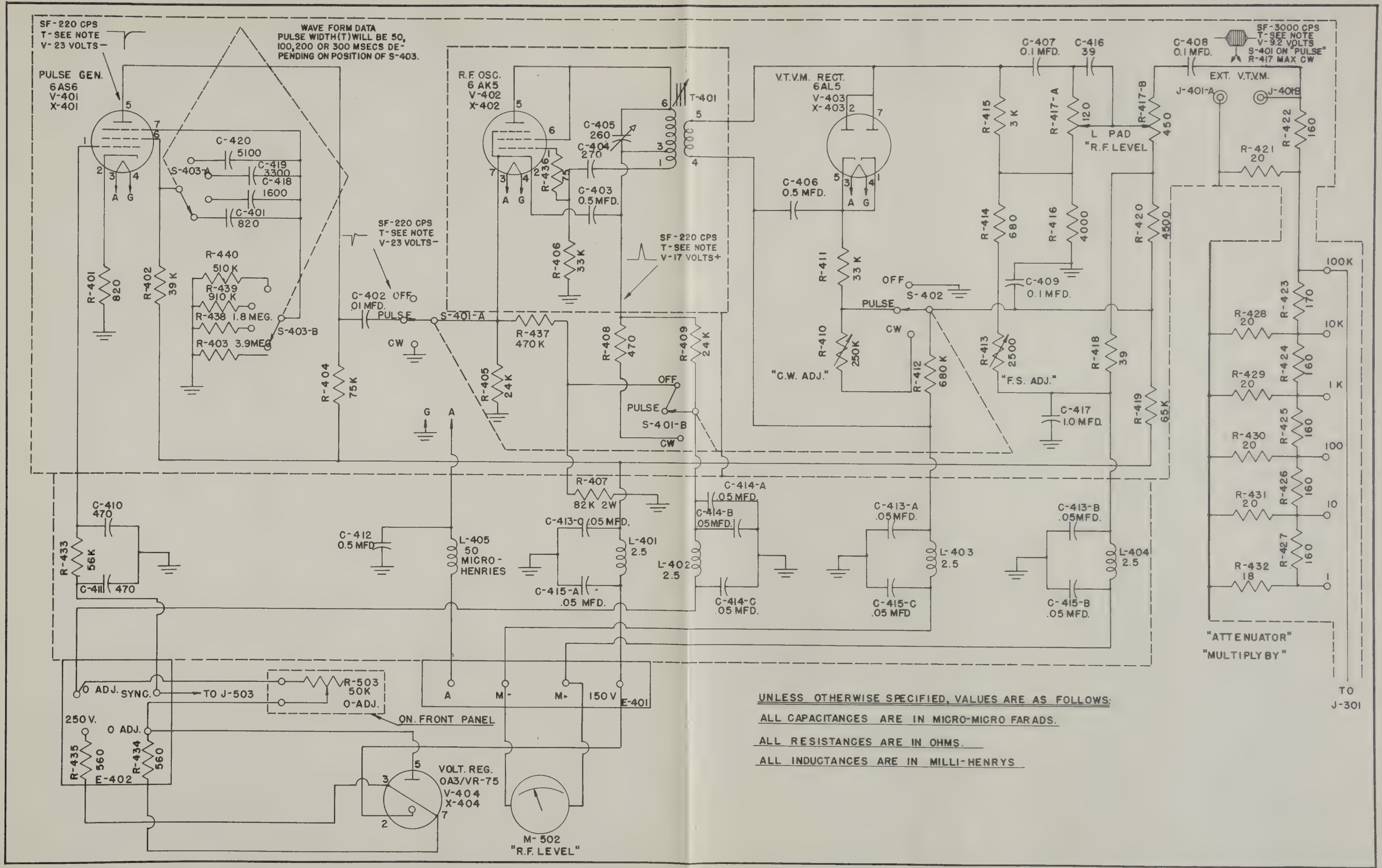


Figure 7-33. Schematic, Signal Generator Unit, IM-14/UP

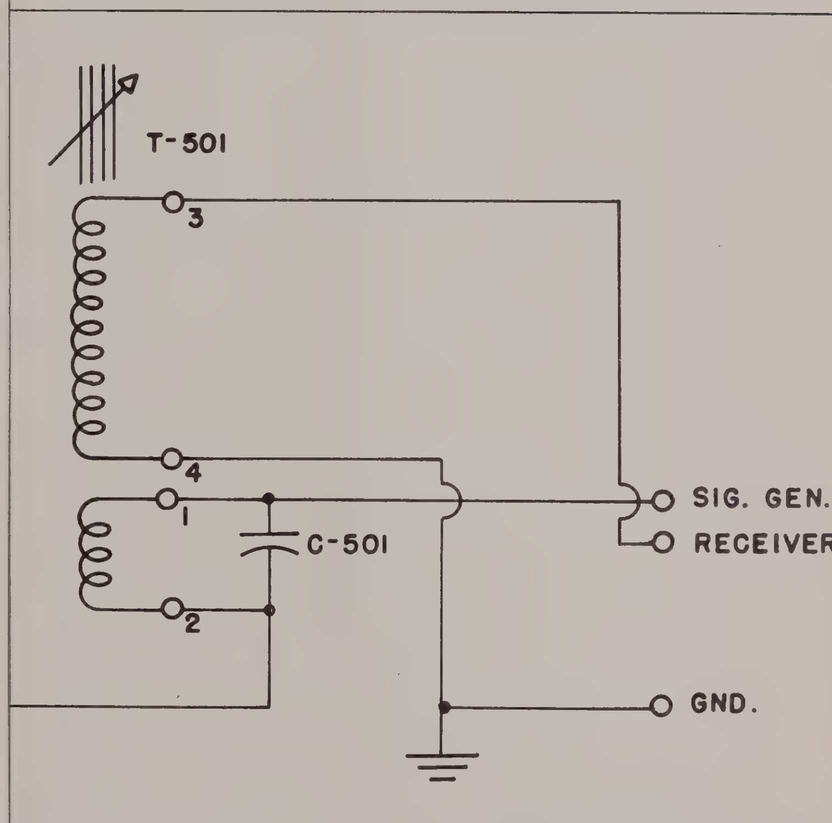


Figure 7–34. Schematic, Antenna Coupler CU–142/U

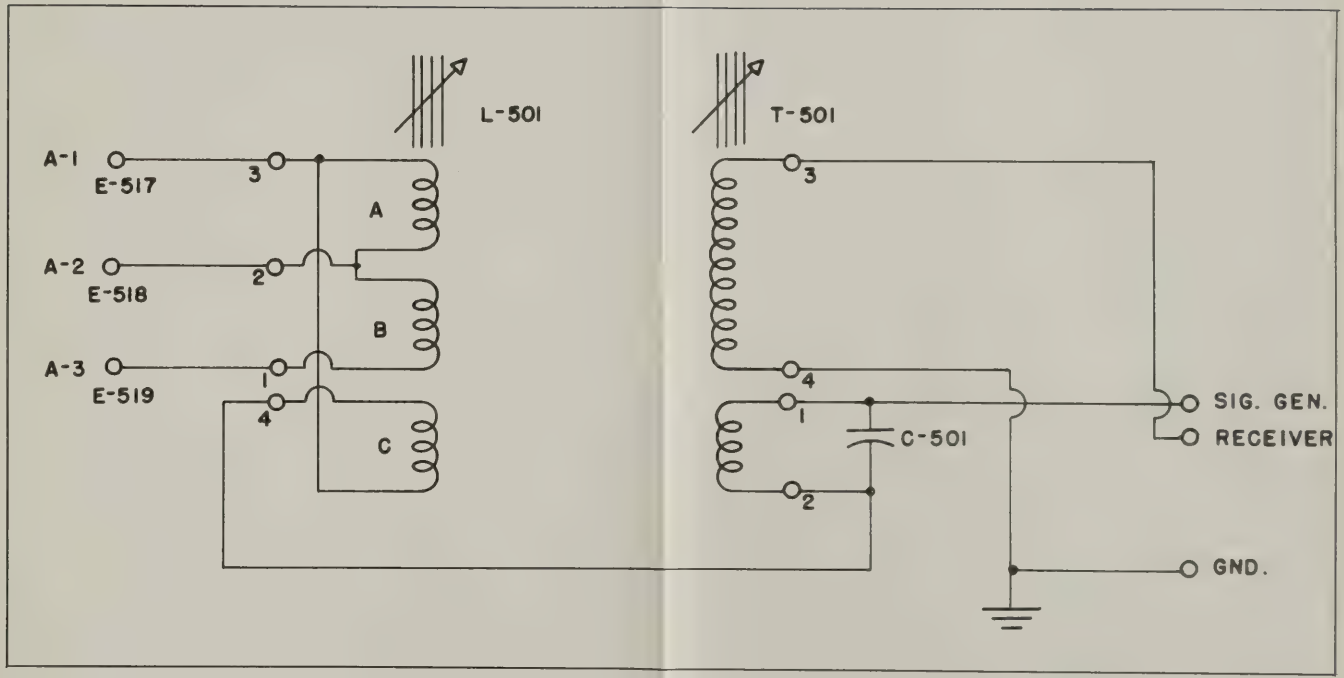


Figure 7-34. Schematic, Antenna Coupler CU-142/U

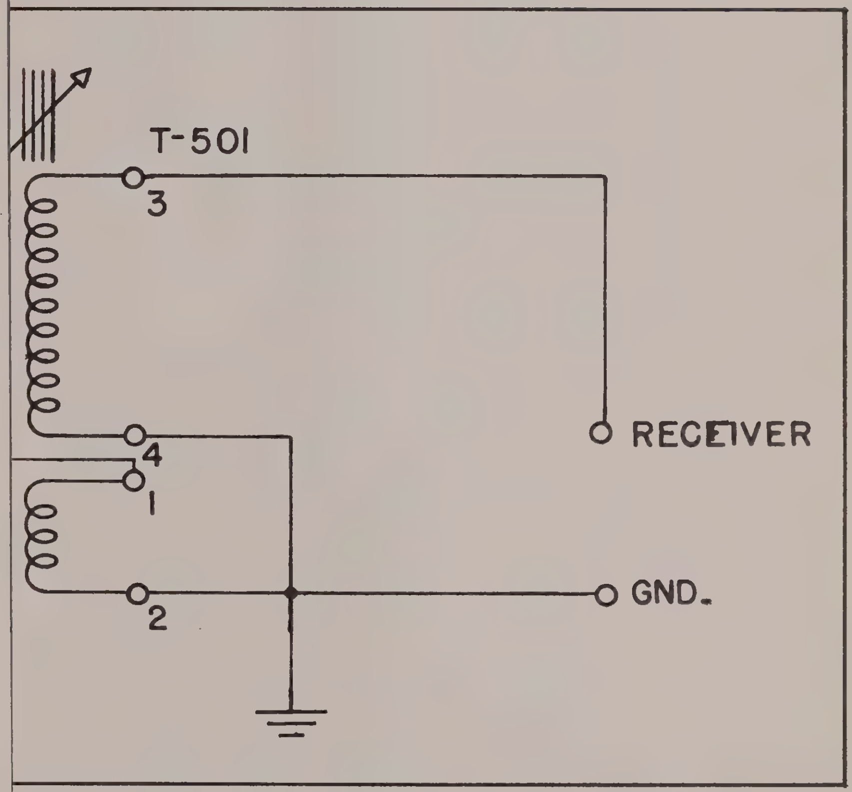


Figure 7–35. Schematic, Antenna Couplet CU–155/U

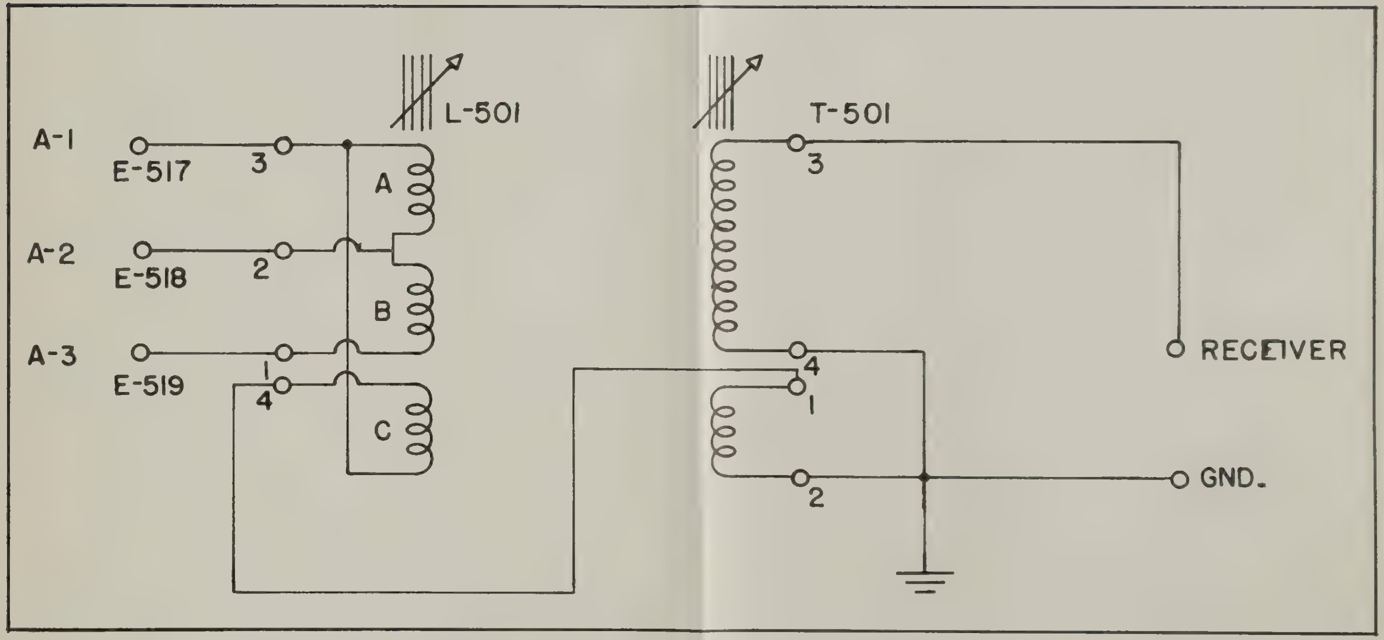


Figure 7-35. Schematic, Antenna Couplet CU-155 U

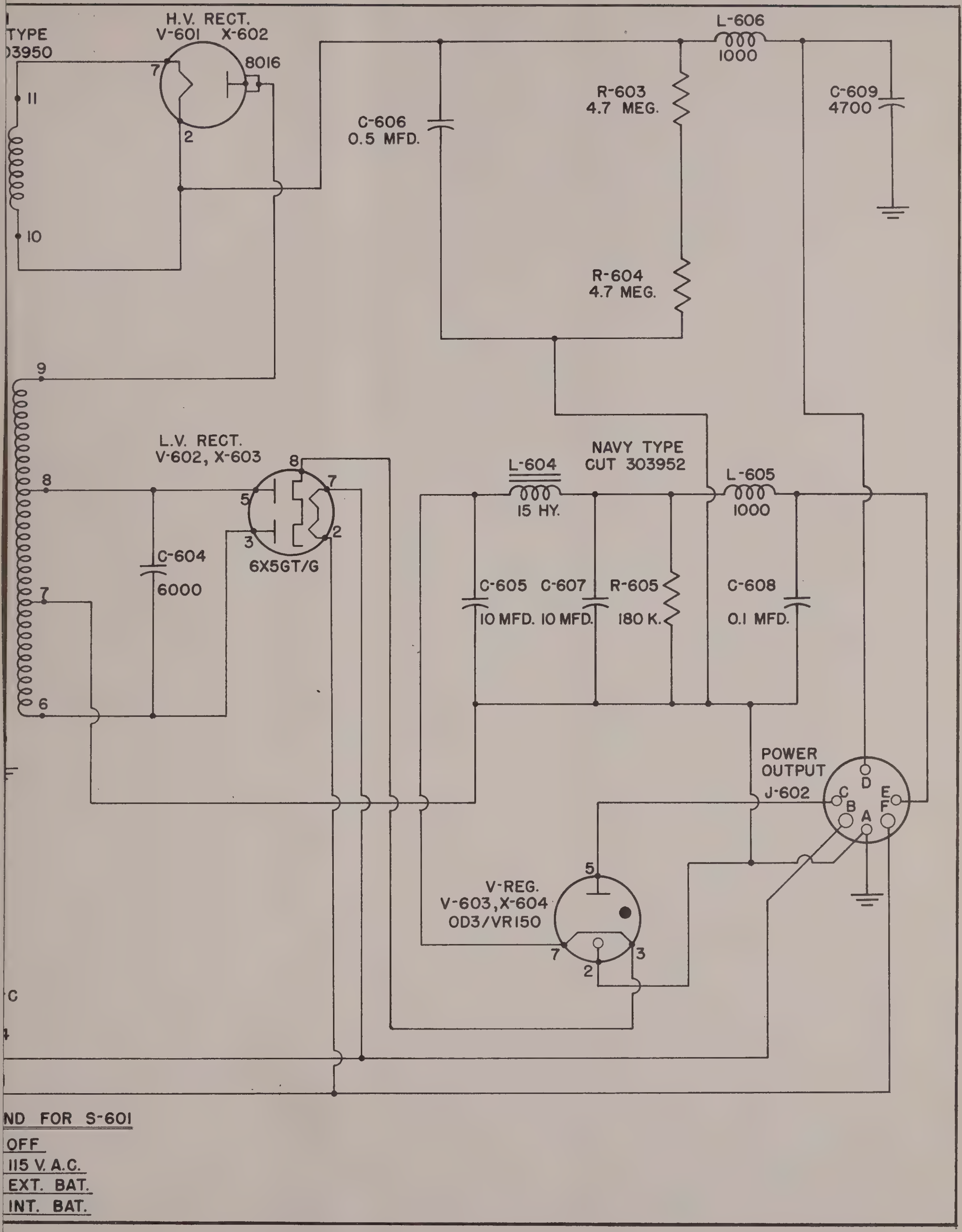


Figure 7-36. Schematic, Power Supply PP-287/U

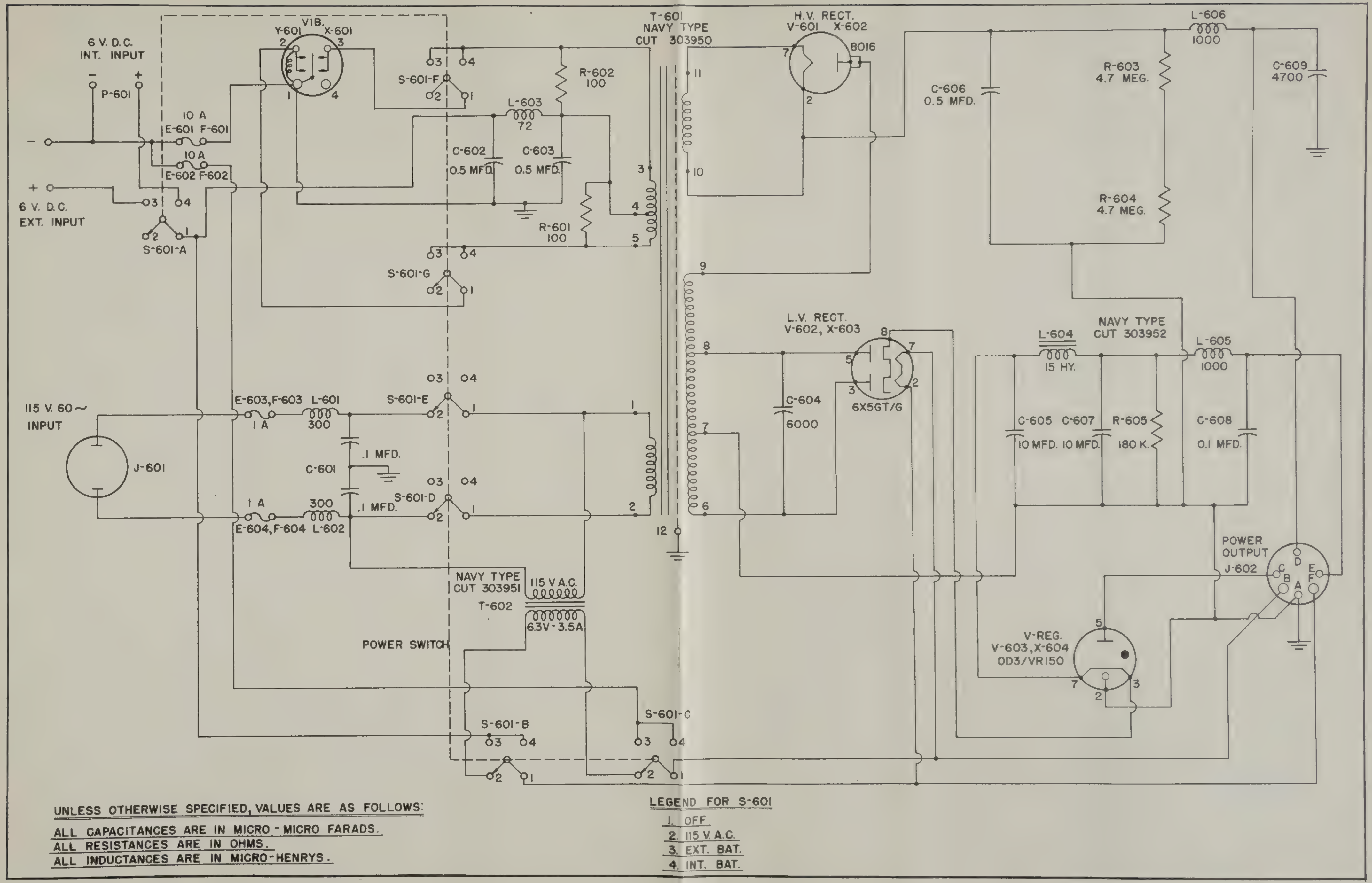


Figure 7–36. Schematic, Power Supply PP–287/U

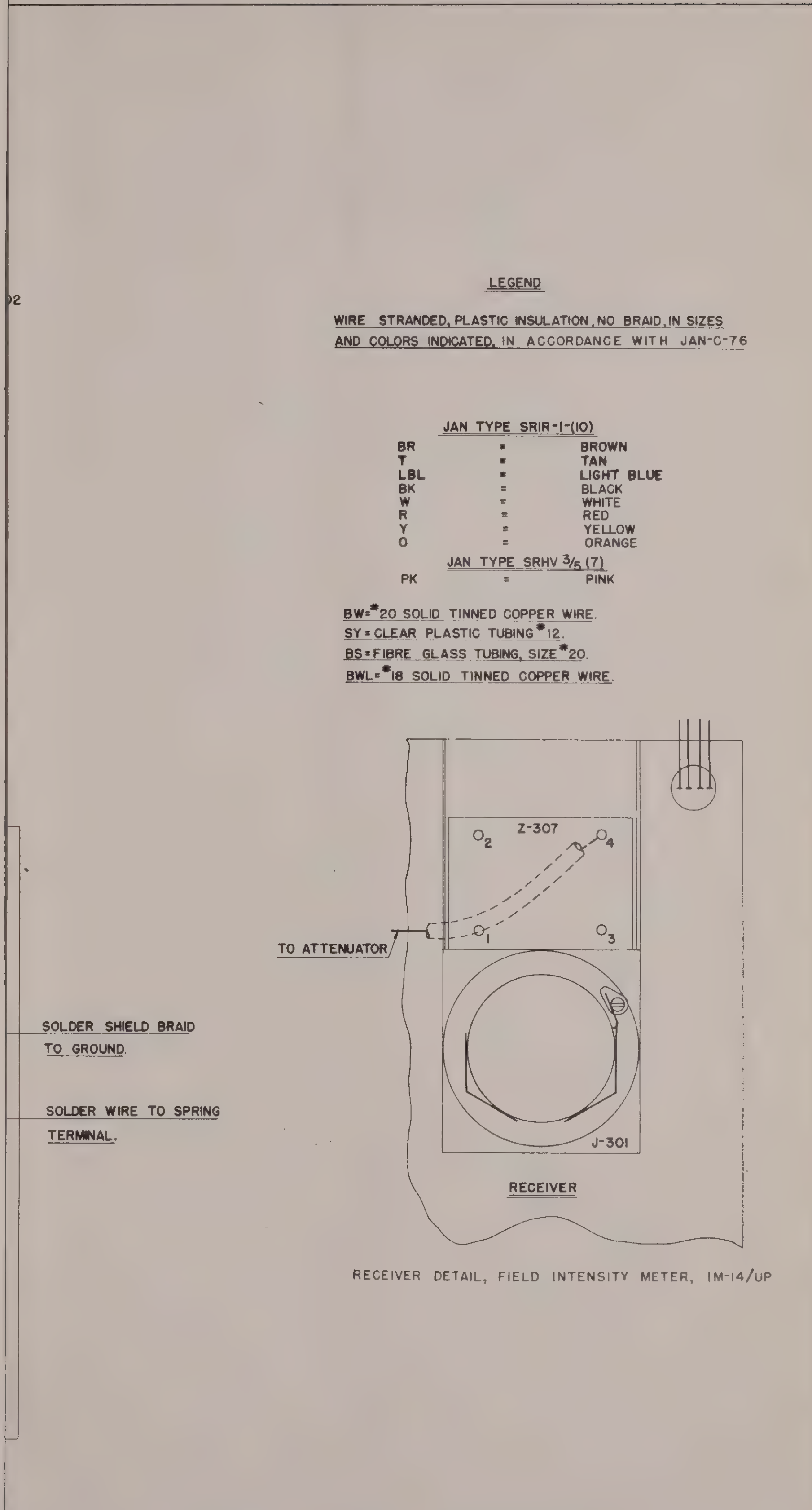


Figure 7–37. Wiring Diagram, Field Intensity Meter, TS–318/UP or TS–635/UP

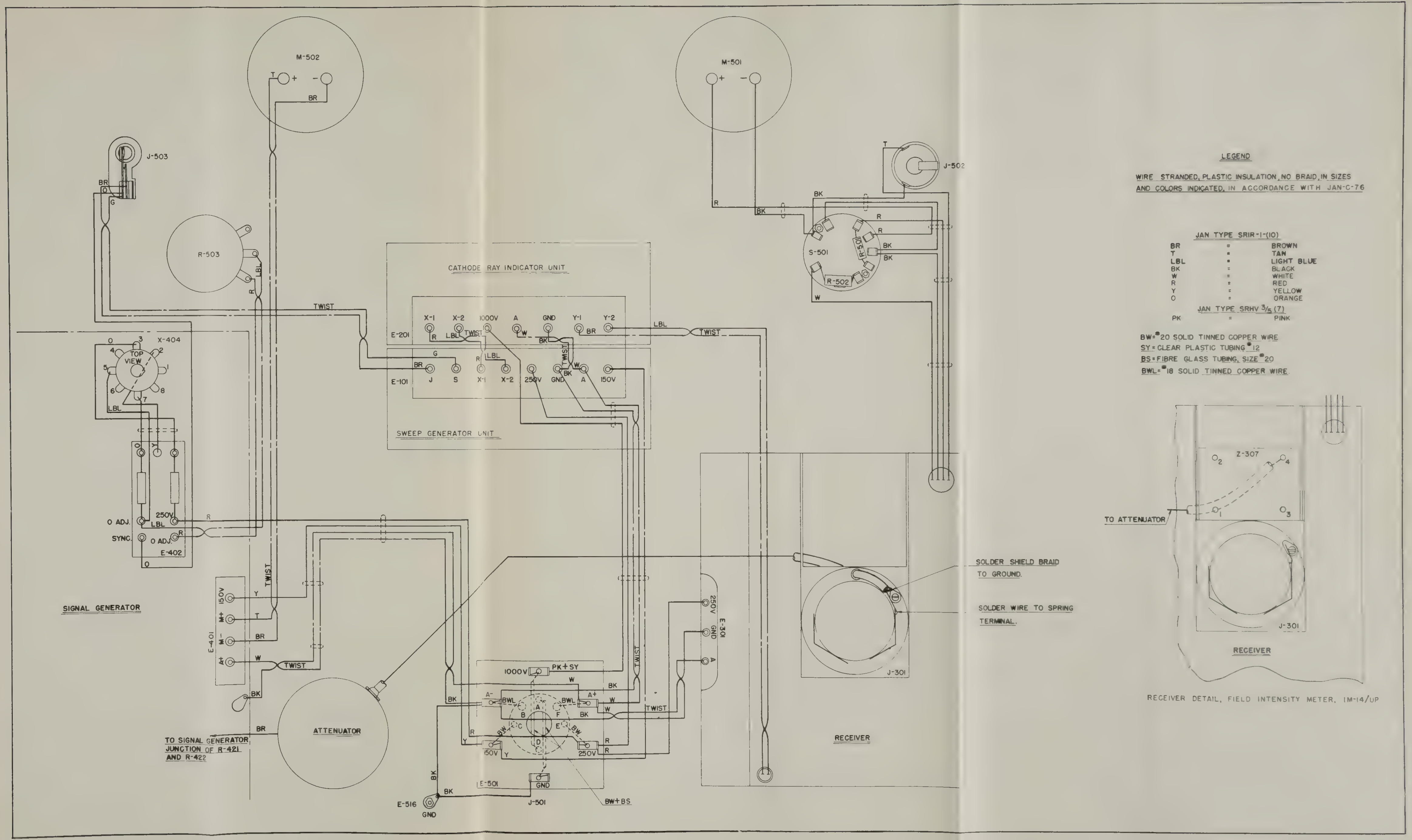


Figure 7-37. Wiring Diagram, Field Intensity Meter, TS-318/UP or TS-635 UP

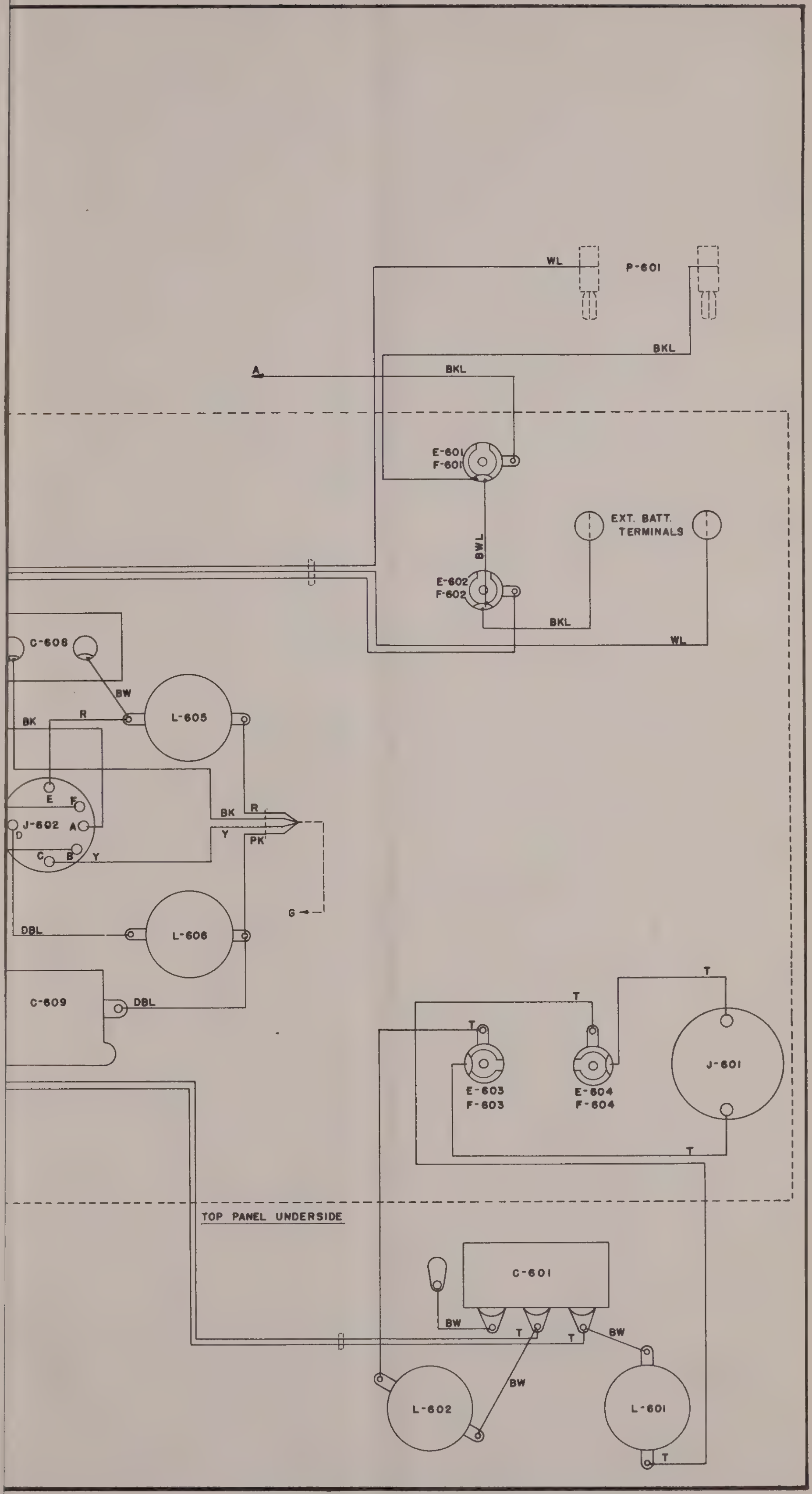


Figure 7–38. Wiring Diagram, Power Supply PP–287/U

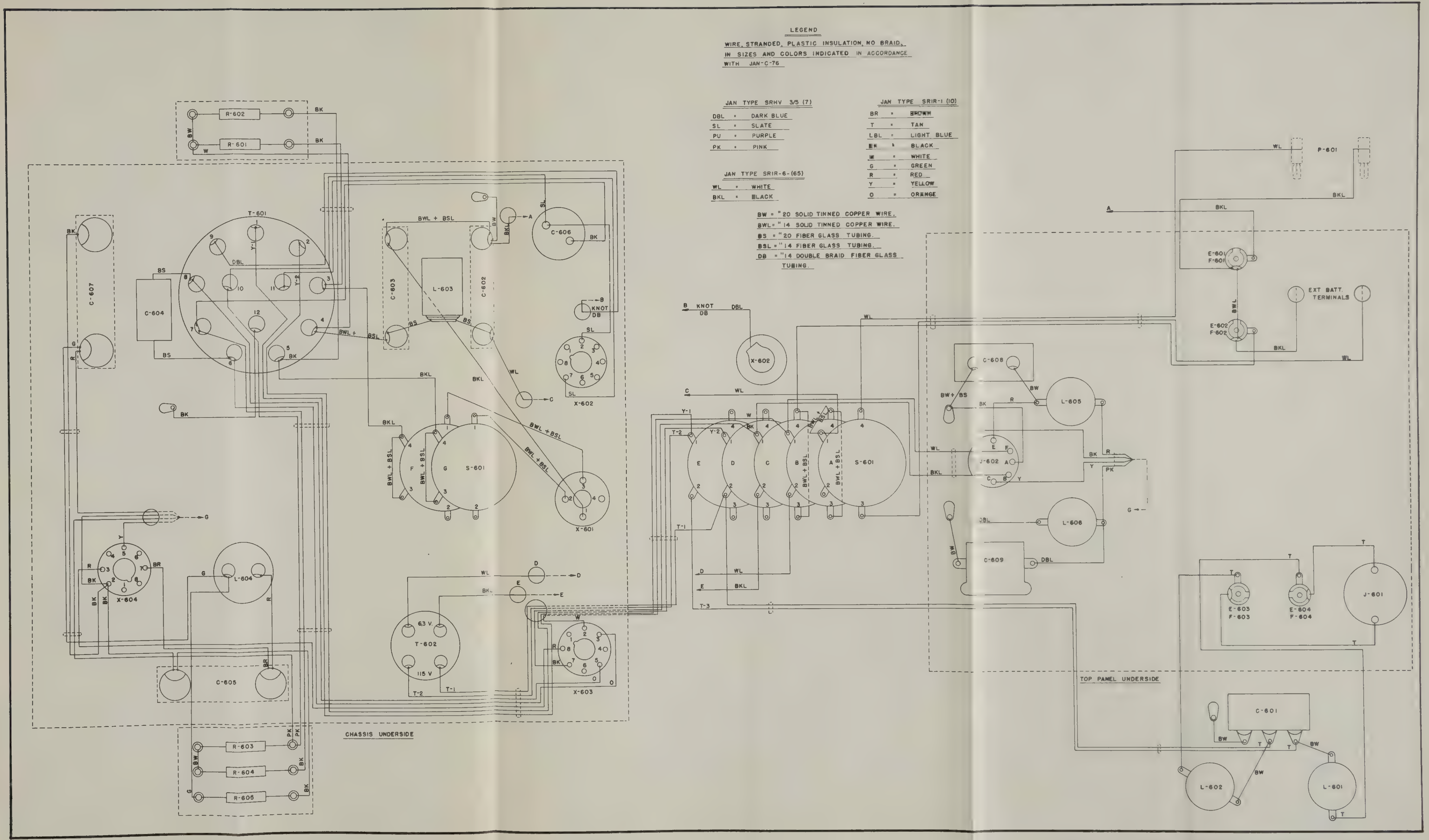


Figure 7–38. Wiring Diagram, Power Supply PP–287/U

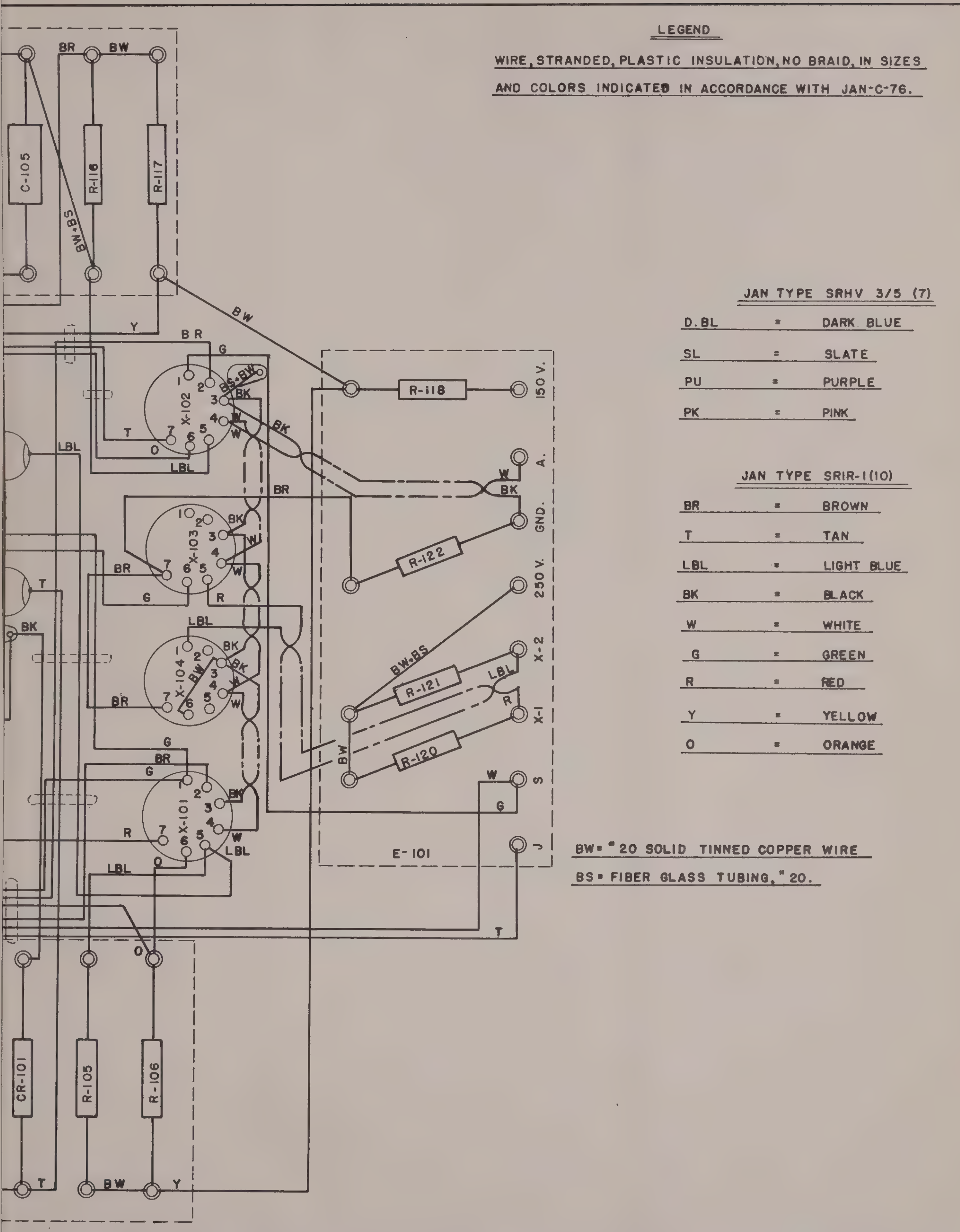


Figure 7–39. Wiring Diagram, Sweep Generator Unit

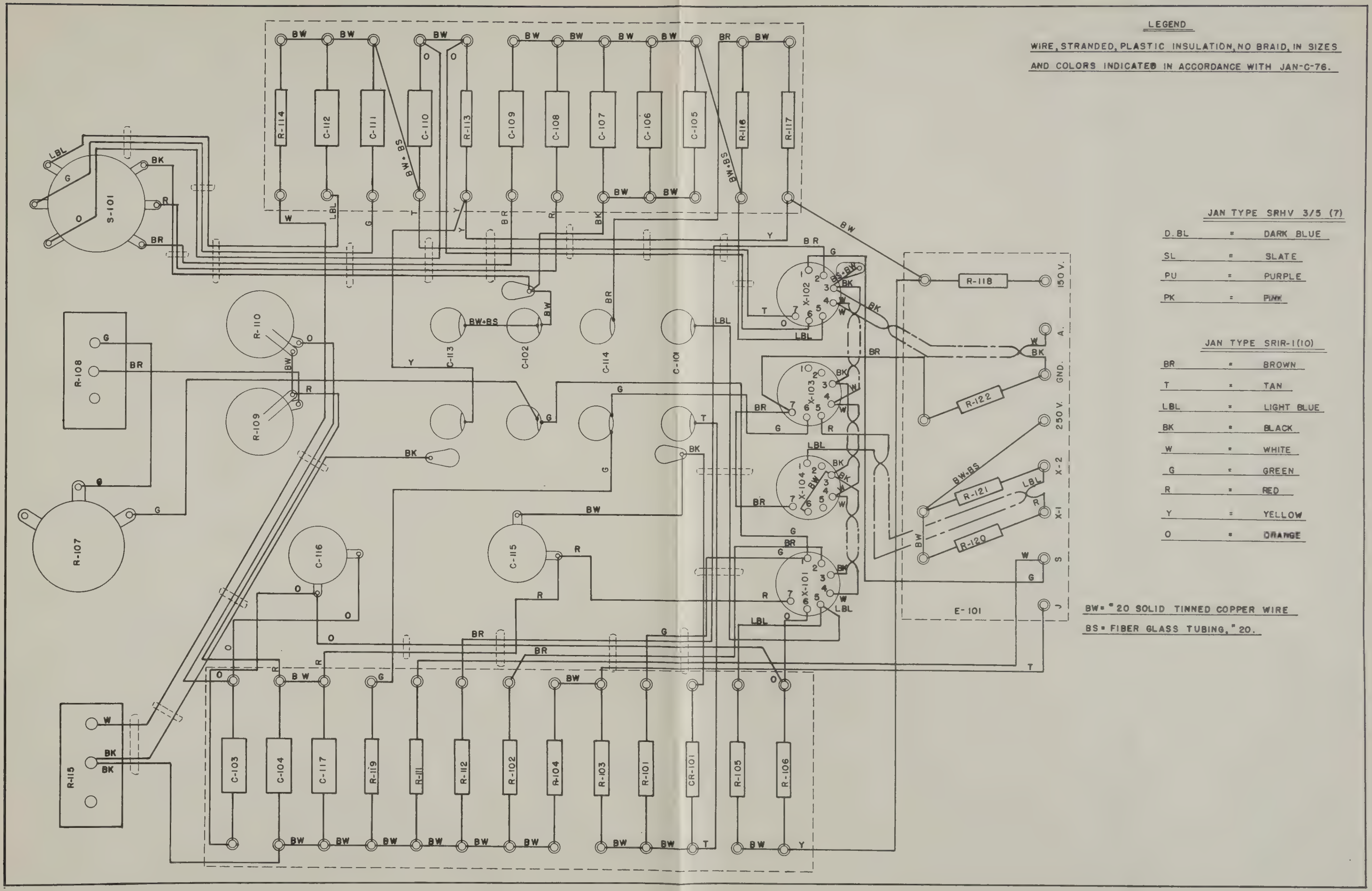


Figure 7-39. Wiring Diagram, Sweep Generator Unit

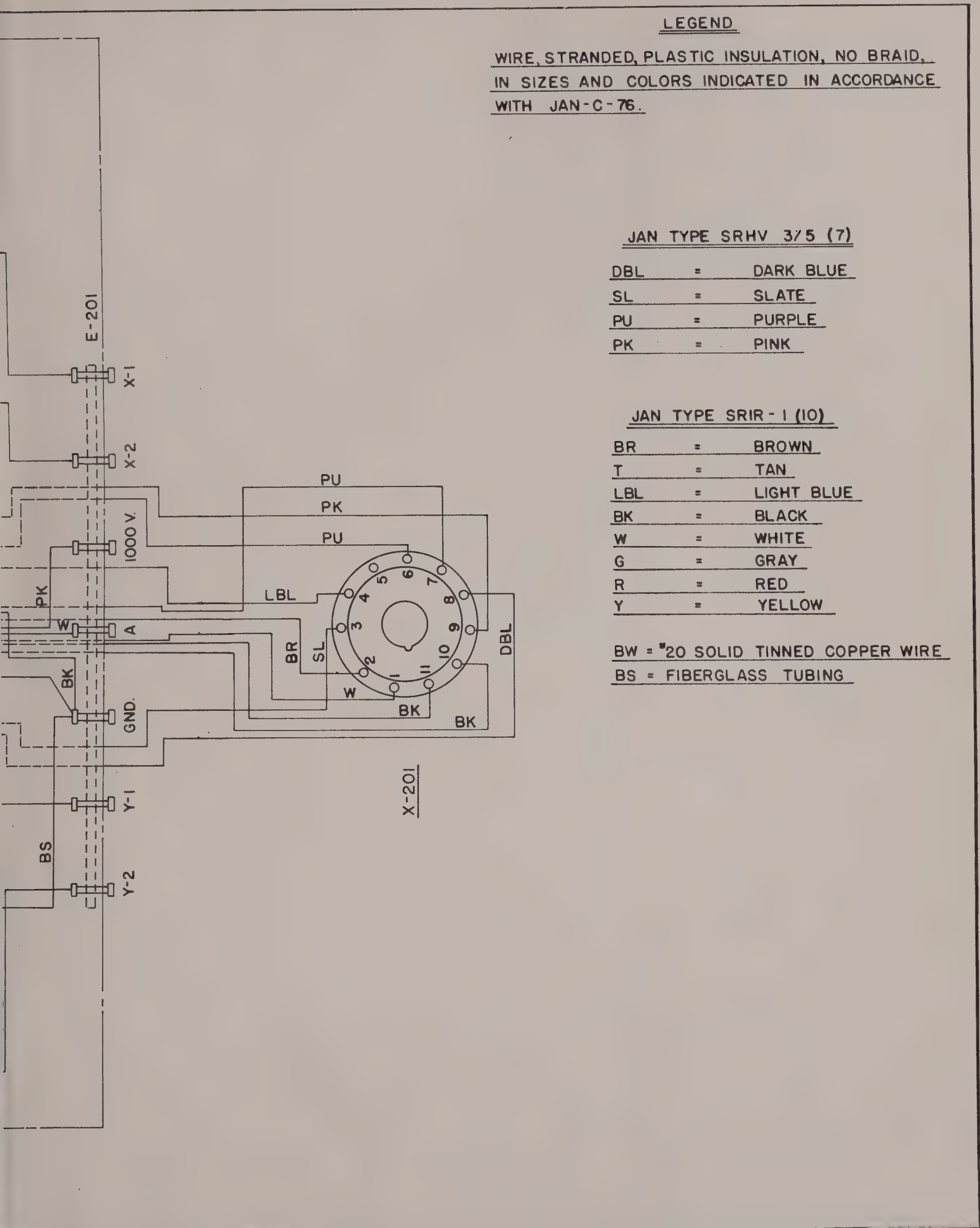
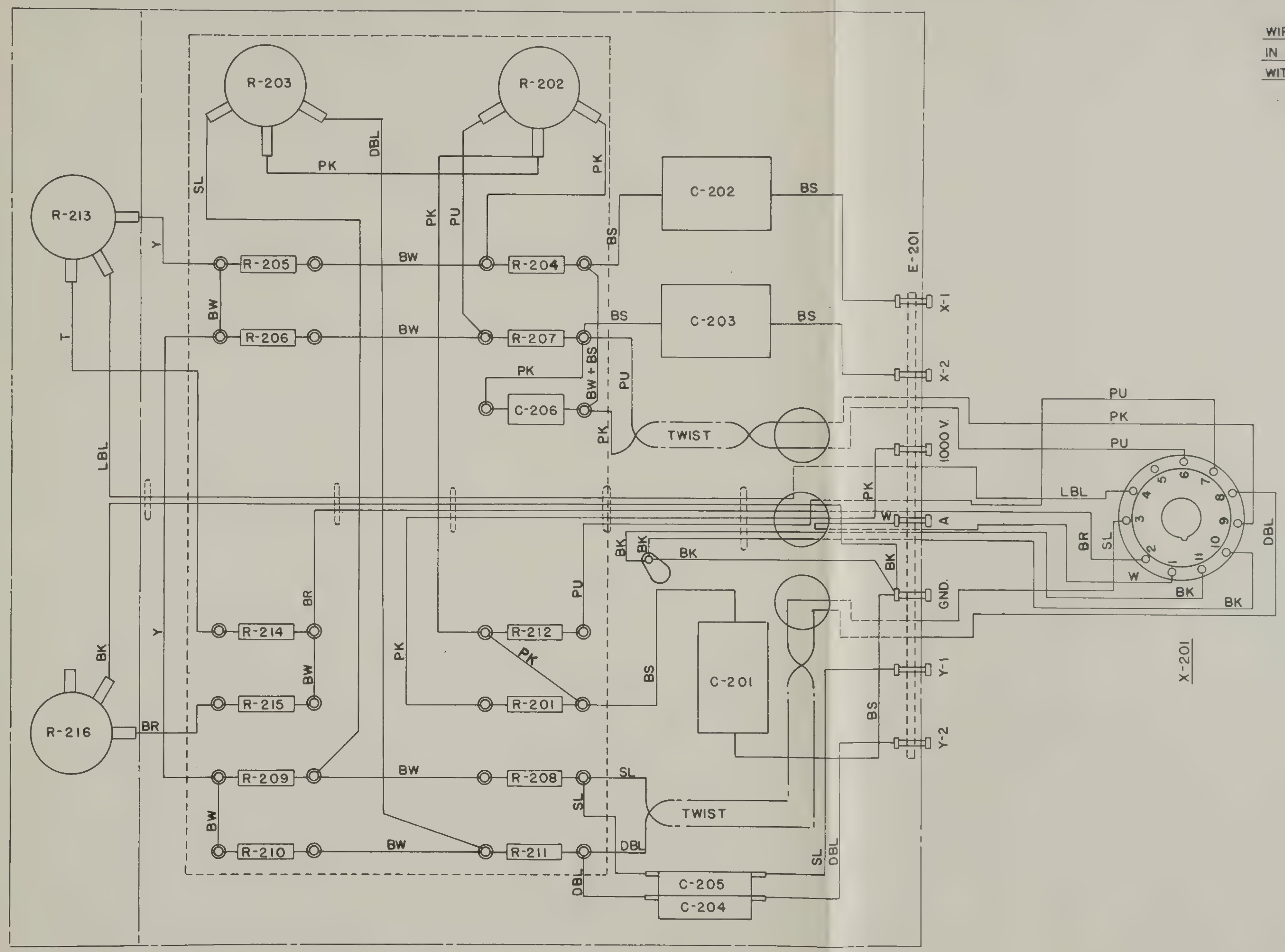


Figure 7–40. Wiring Diagram, Cathode Ray Indicator Unit



LEGEND

WIRE, STRANDED, PLASTIC INSULATION, NO BRAID, IN SIZES AND COLORS INDICATED IN ACCORDANCE WITH JAN-C-76.

JAN TYPE SRHV 3/5 (7)

DBL	=	DARK BLUE
SL	=	SLATE
PU	=	PURPLE
PK	=	PINK

JAN TYPE SRIR - I (10)

BR	=	BROWN
T	=	TAN
LBL	=	LIGHT BLUE
BK	=	BLACK
W	=	WHITE
G	=	GRAY
R	=	RED
Y	=	YELLOW

BW = #20 SOLID TINNED COPPER WIRE
BS = FIBERGLASS TUBING

Figure 7-40. Wiring Diagram, Cathode Ray Indicator Unit

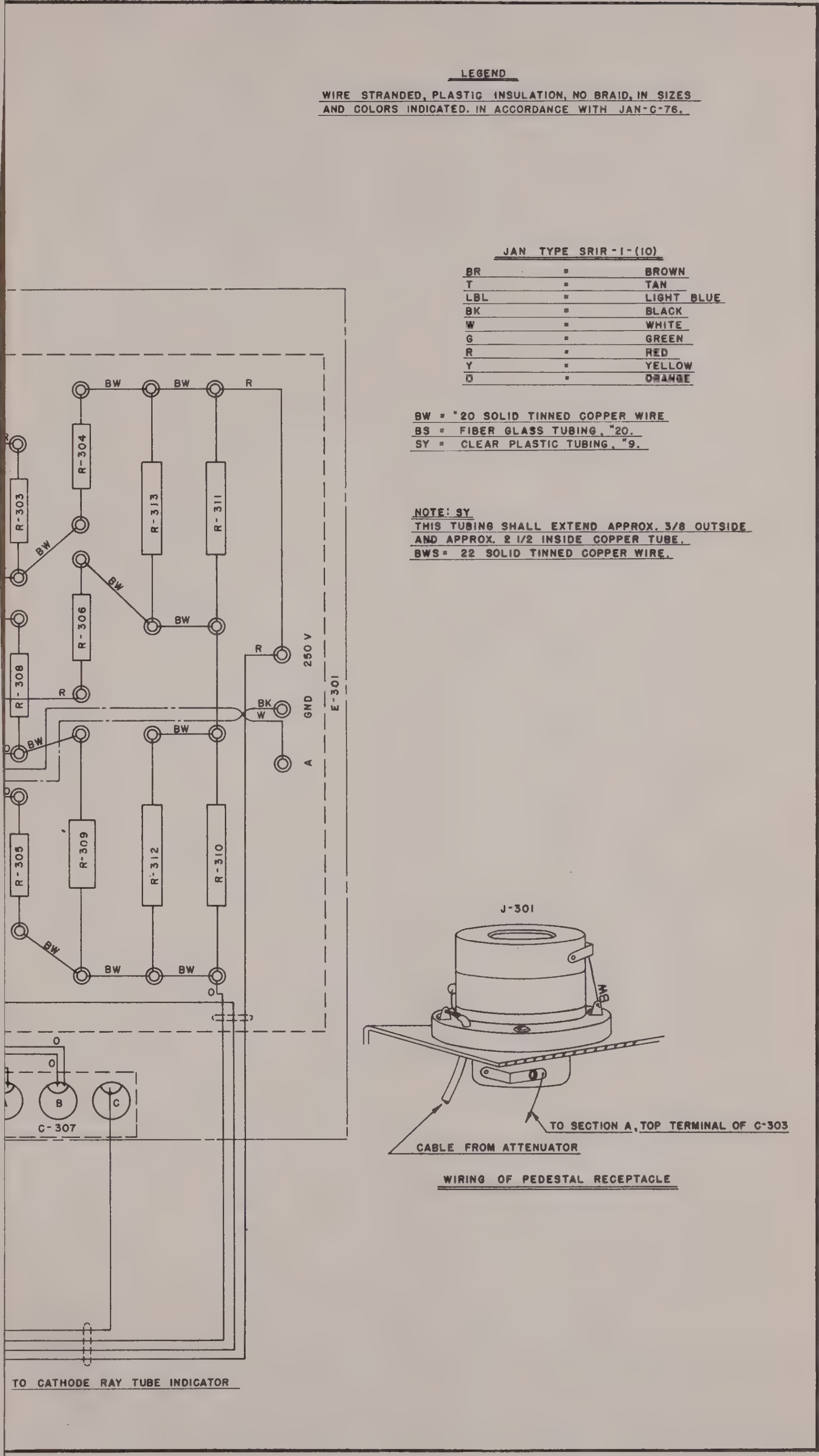
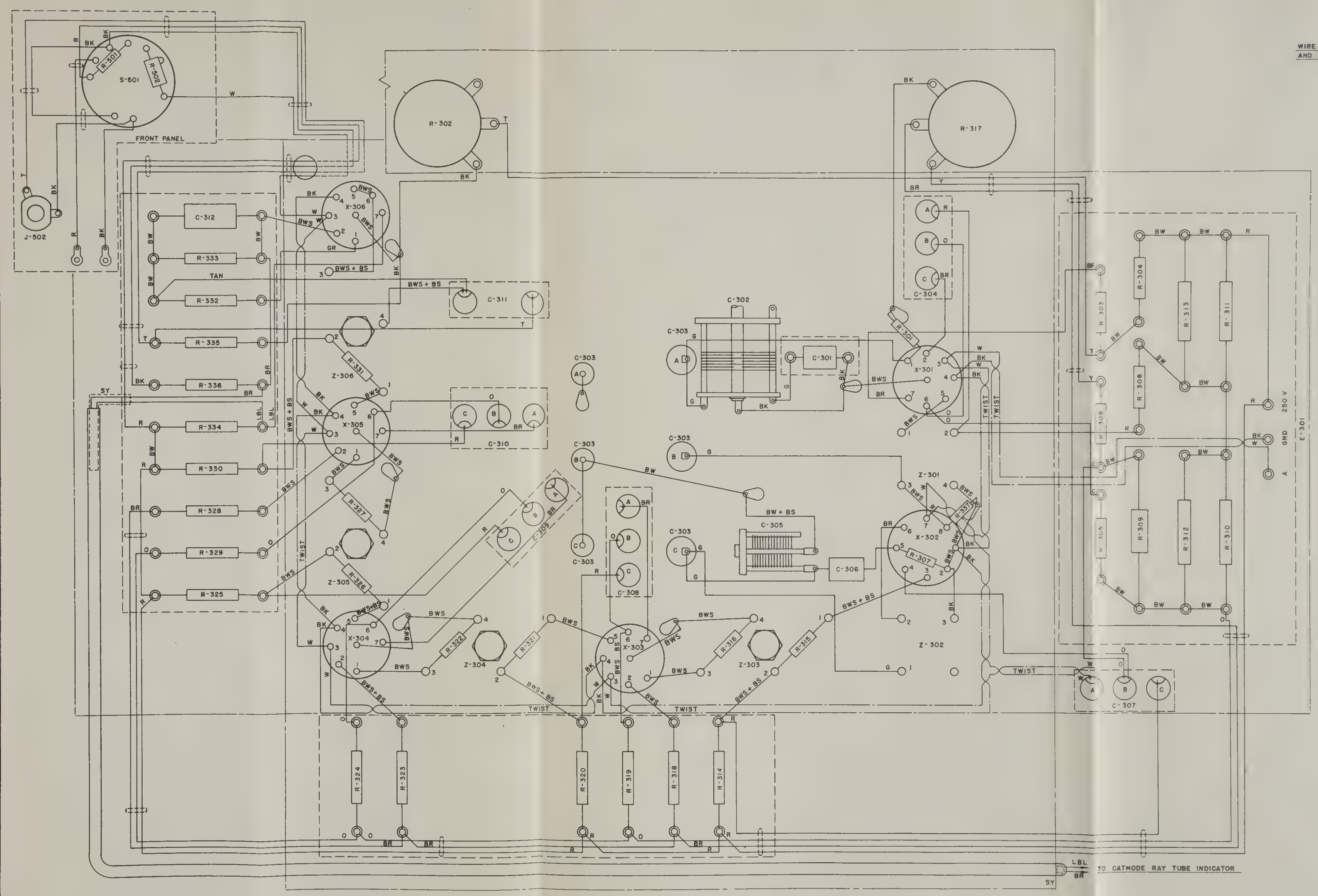


Figure 7–41. Wiring Diagram, Receiver, IM–10/UP



LEGEND

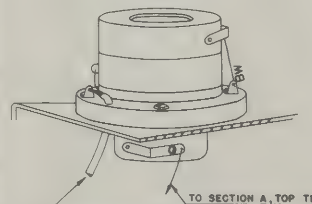
WIRE STRANDED, PLASTIC INSULATION, NO BRAID, IN SIZES AND COLORS INDICATED. IN ACCORDANCE WITH JAN-C-76.

JAN TYPE SRIR-1-(10)

BR	=	BROWN
T	=	TAN
LBL	=	LIGHT BLUE
BK	=	BLACK
W	=	WHITE
G	=	GREEN
R	=	RED
Y	=	YELLOW
O	=	ORANGE

BW = "20 SOLID TINNED COPPER WIRE
BS = FIBER GLASS TUBING, "20.
SY = CLEAR PLASTIC TUBING, "9.

NOTE: SY
THIS TUBING SHALL EXTEND APPROX. 3/8 OUTSIDE AND APPROX. 2 1/2 INSIDE COPPER TUBE.
BWS = 22 SOLID TINNED COPPER WIRE.



WIRING OF PEDESTAL RECEPTACLE

Figure 7-41. Wiring Diagram, Receiver, IM-10/UP

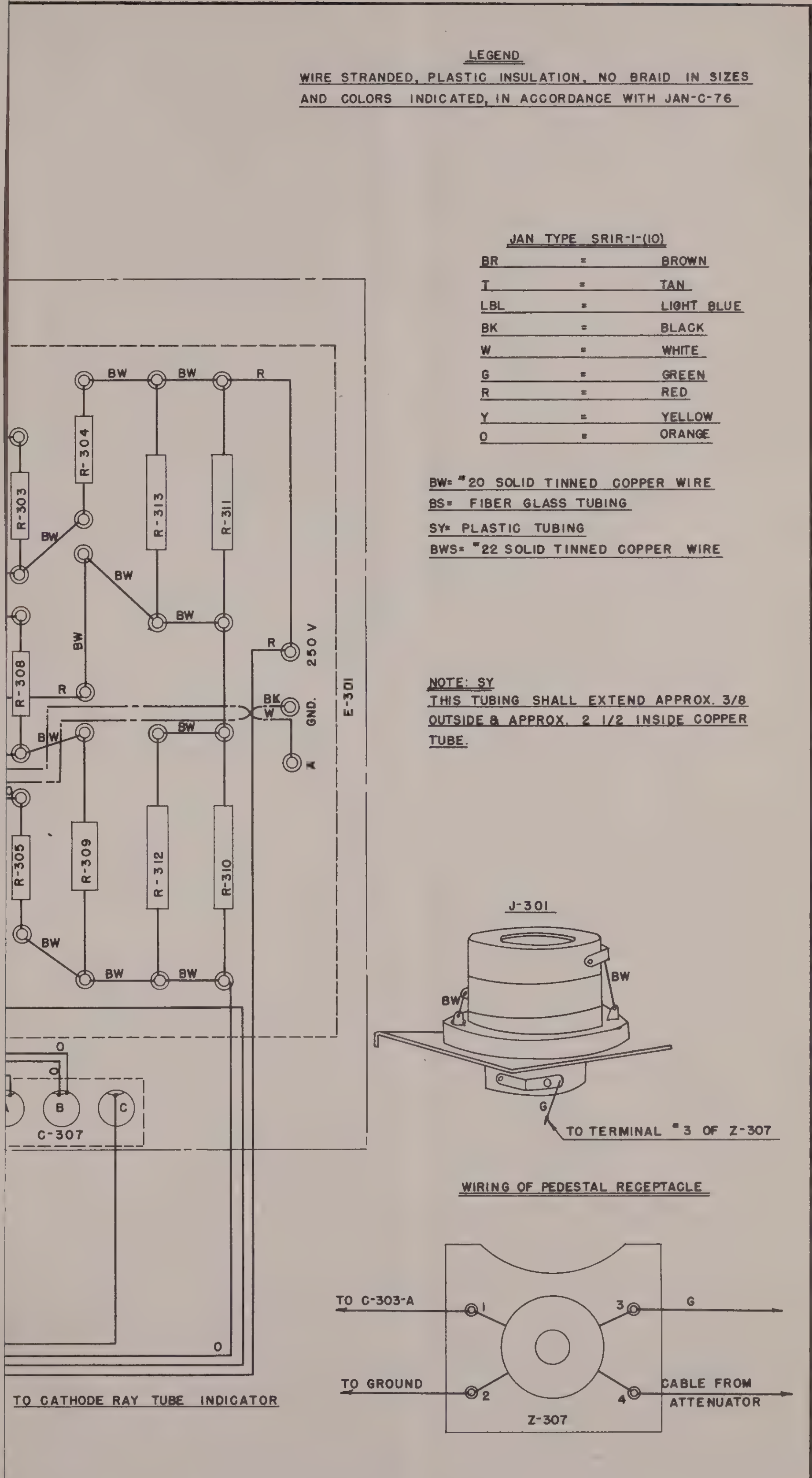


Figure 7–42. Wiring Diagram, Receiver, IM–14/UP

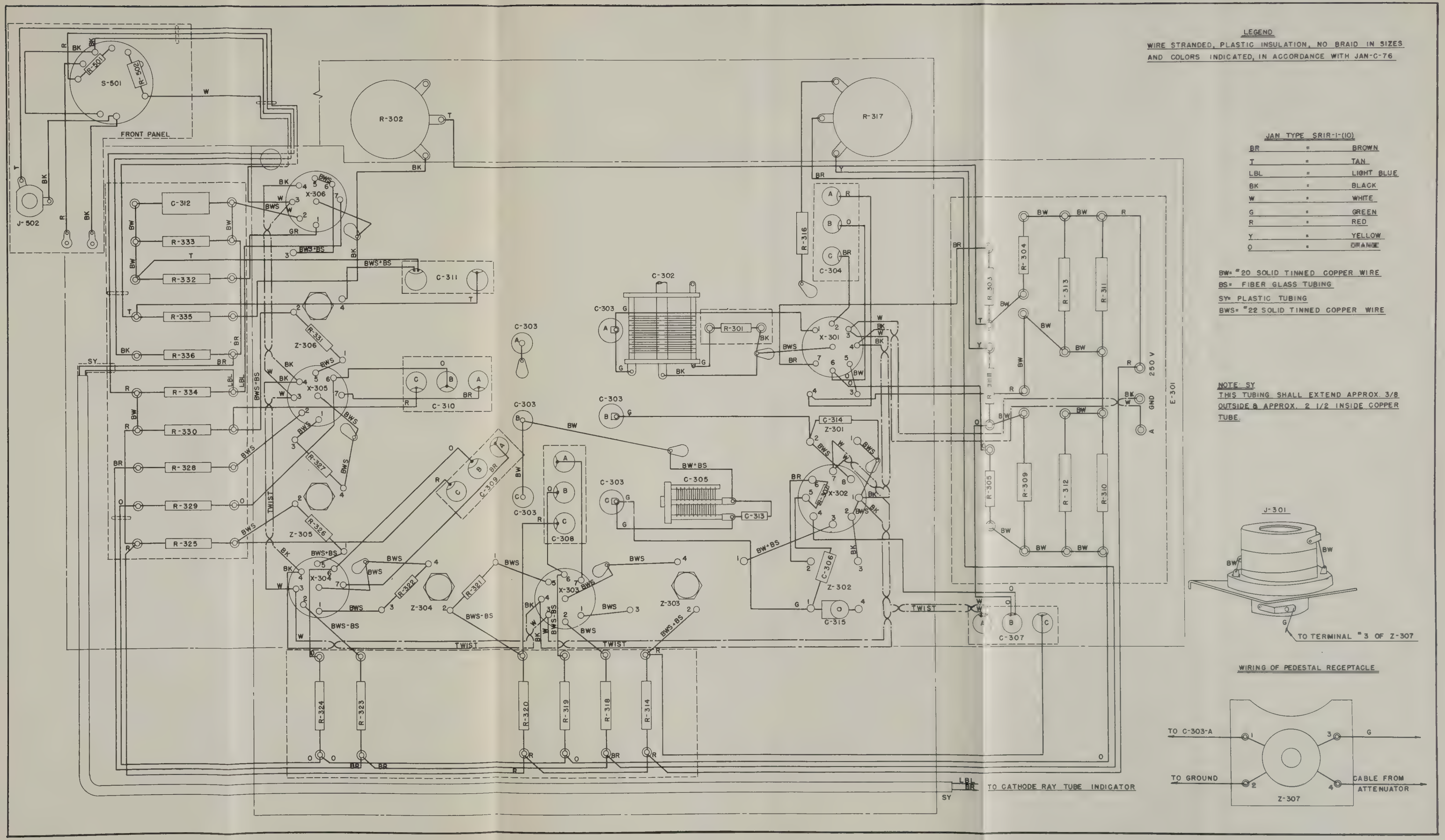


Figure 7-42. Wiring Diagram, Receiver, IM-14/UP

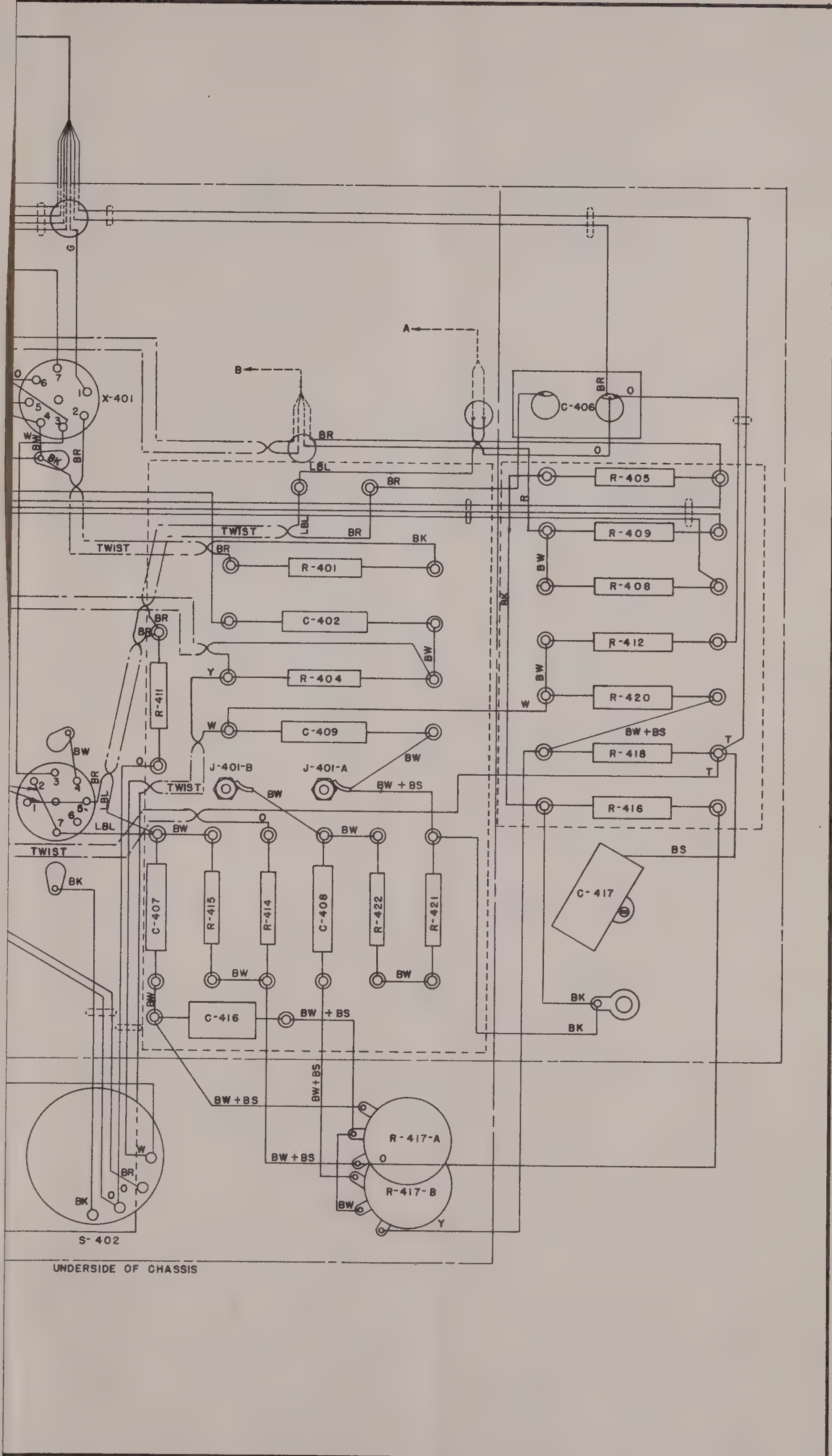


Figure 7–43. Wiring Diagram, Signal Generator Unit, IM–10/UP

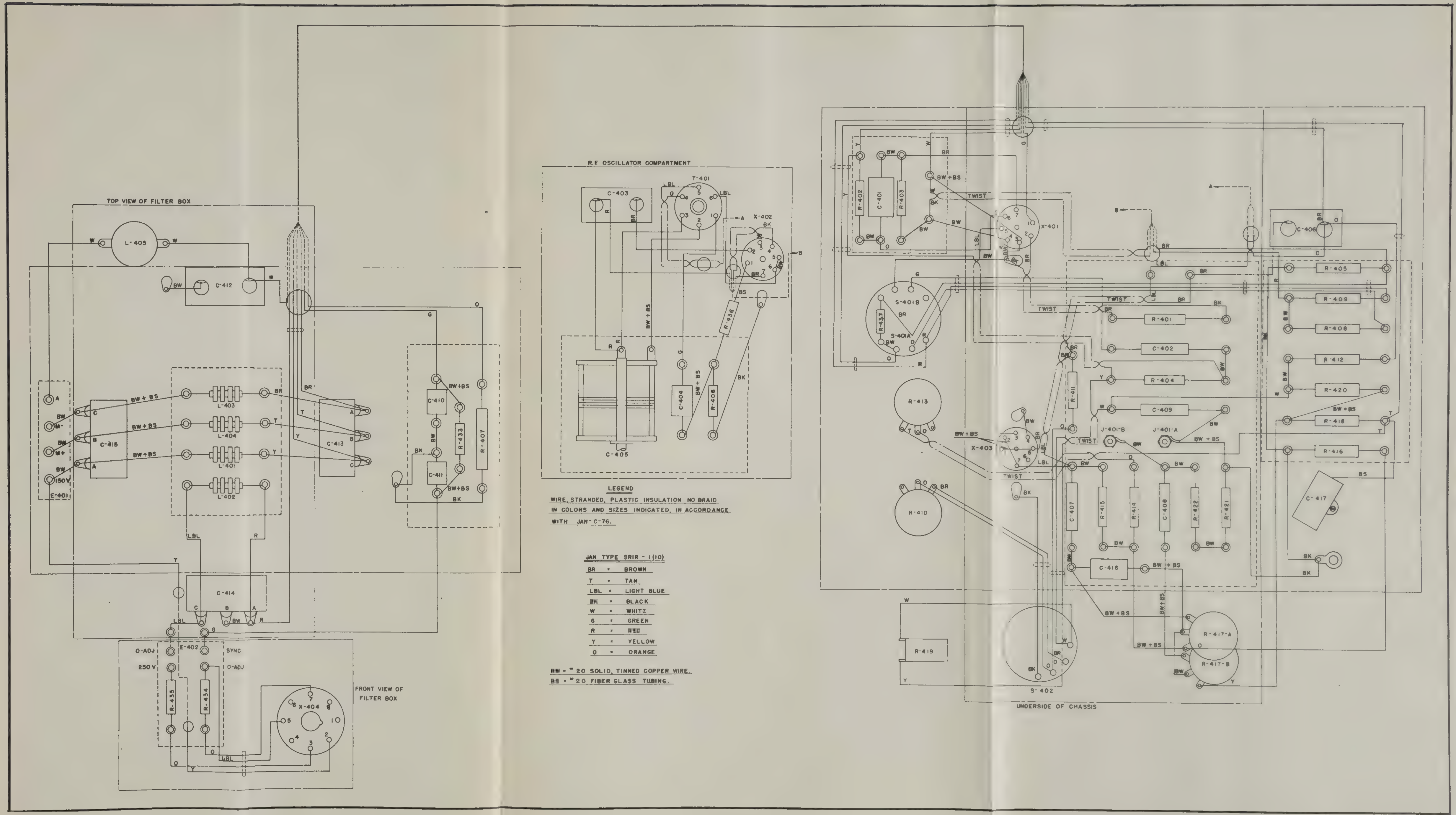


Figure 7-43. Wiring Diagram, Signal Generator Unit, IM-10/UP

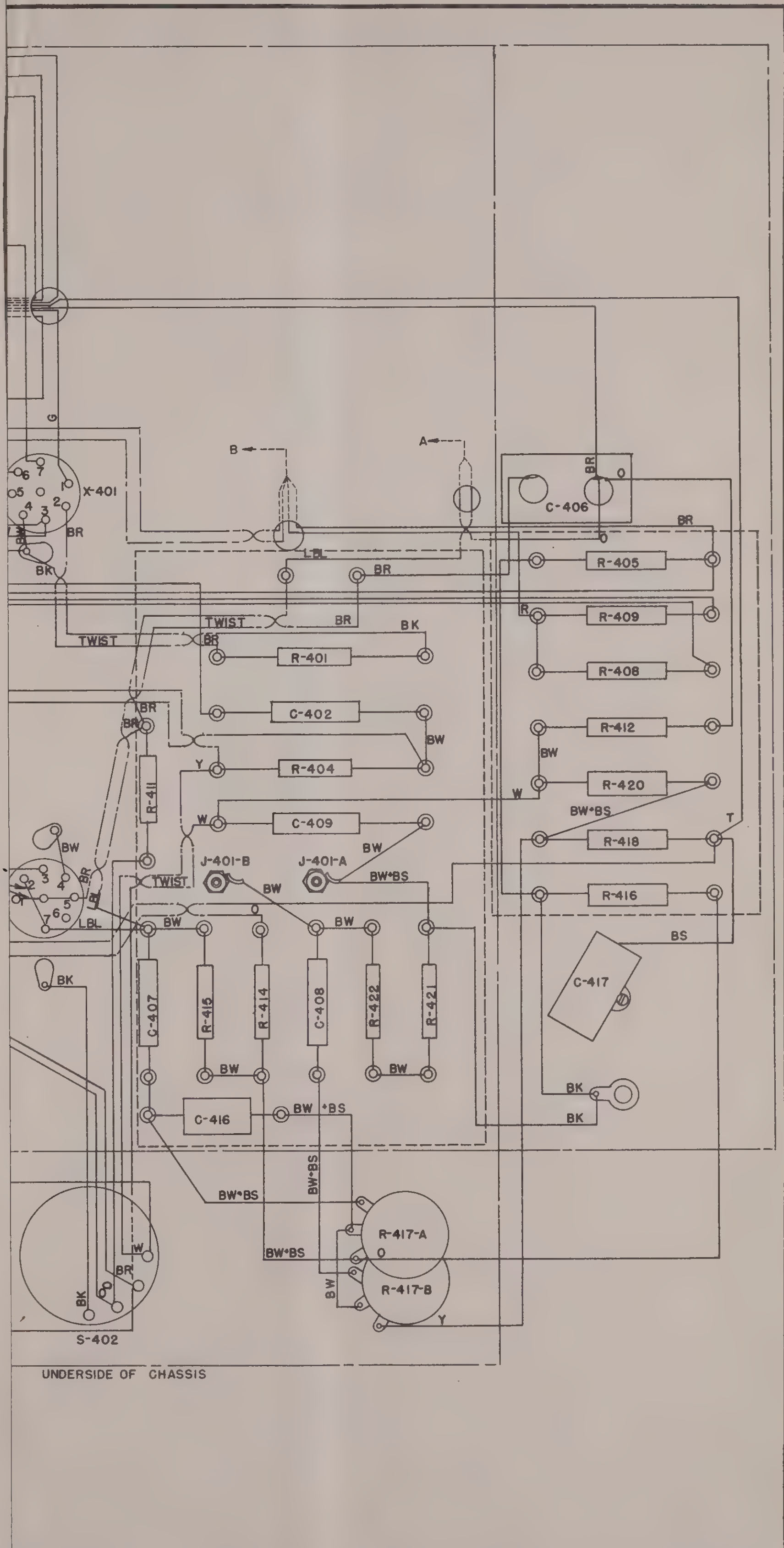


Figure 7–44. Wiring Diagram, Signal Generator Unit, IM–14/UP

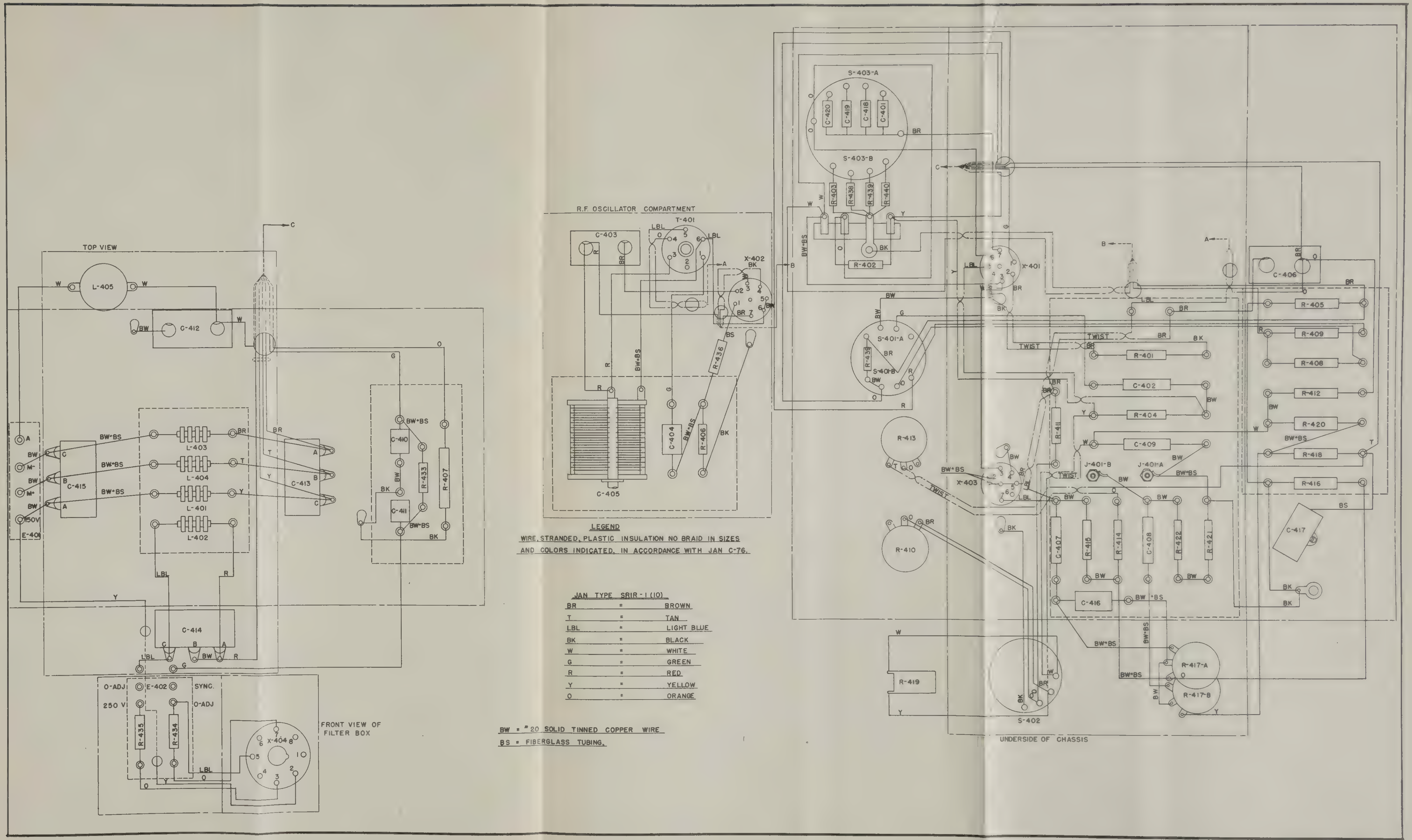


Figure 7–44. Wiring Diagram, Signal Generator Unit, IM–14/UP

LEGEND

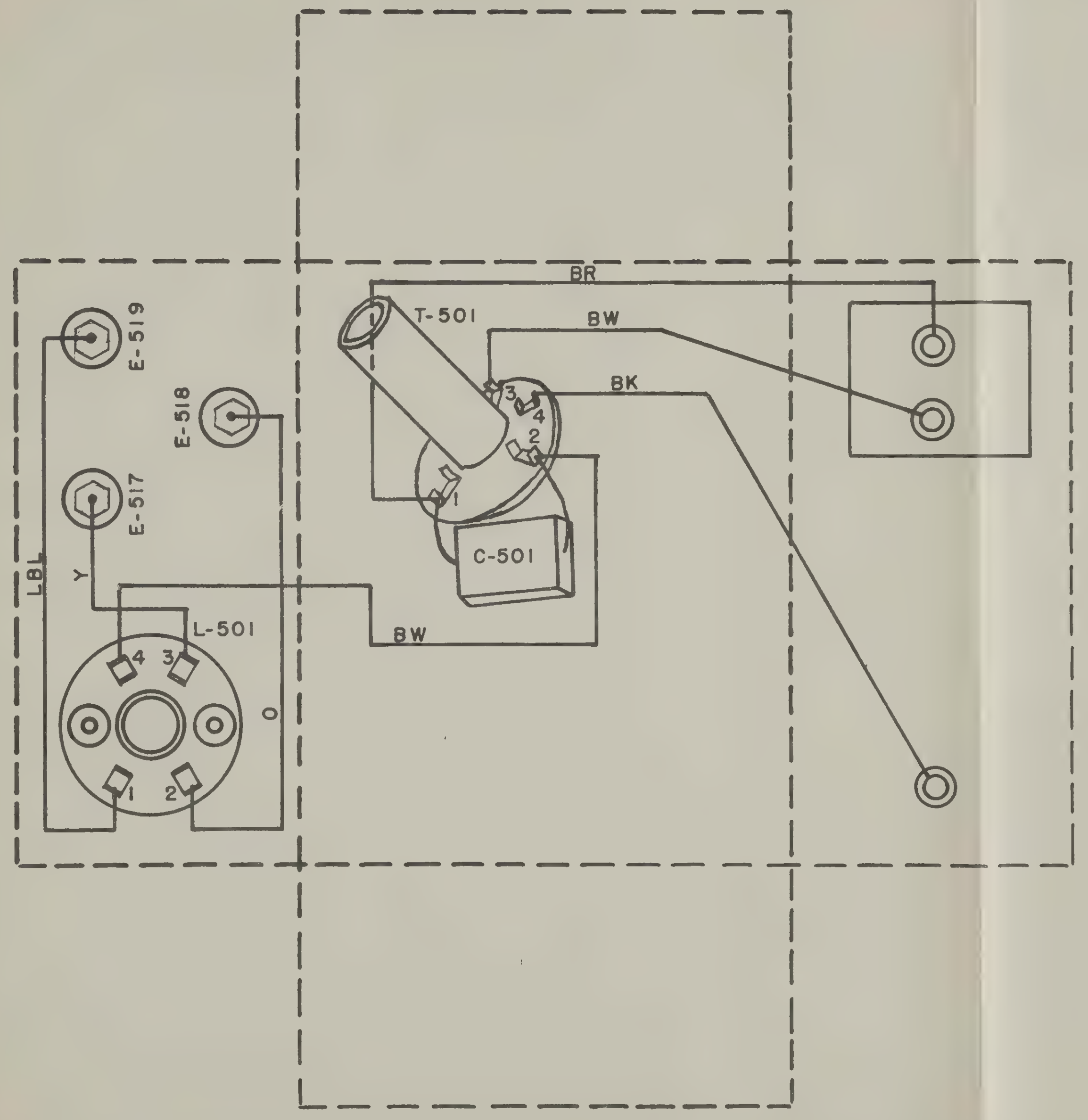
WIRE, STRANDED, PLASTIC INSULATION, NO BRAID, IN SIZE AND COLORS INDICATED, IN ACCORDANCE WITH JAN-C-76.

JAN TYPE SRIR-1 (10)

BR	=	BROWN
BK	=	BLACK
LBL	=	LIGHT BLUE
Y	=	YELLOW
O	=	ORANGE

BW = #20 SOLID TIN COPPER WIRE

Figure 7–45. Wiring Diagram, Antenna Coupler CU–142/U



LEGEND

WIRE, STRANDED, PLASTIC INSULATION, NO BRAID, IN SIZE AND COLORS INDICATED, IN ACCORDANCE WITH JAN-C-76.

JAN TYPE SRIR-1 (10)		
BR	=	BROWN
BK	=	BLACK
LBL	=	LIGHT BLUE
Y	=	YELLOW
O	=	ORANGE

BW = #20 SOLID TIN COPPER WIRE

Figure 7-45. Wiring Diagram, Antenna Coupler CU-142/U

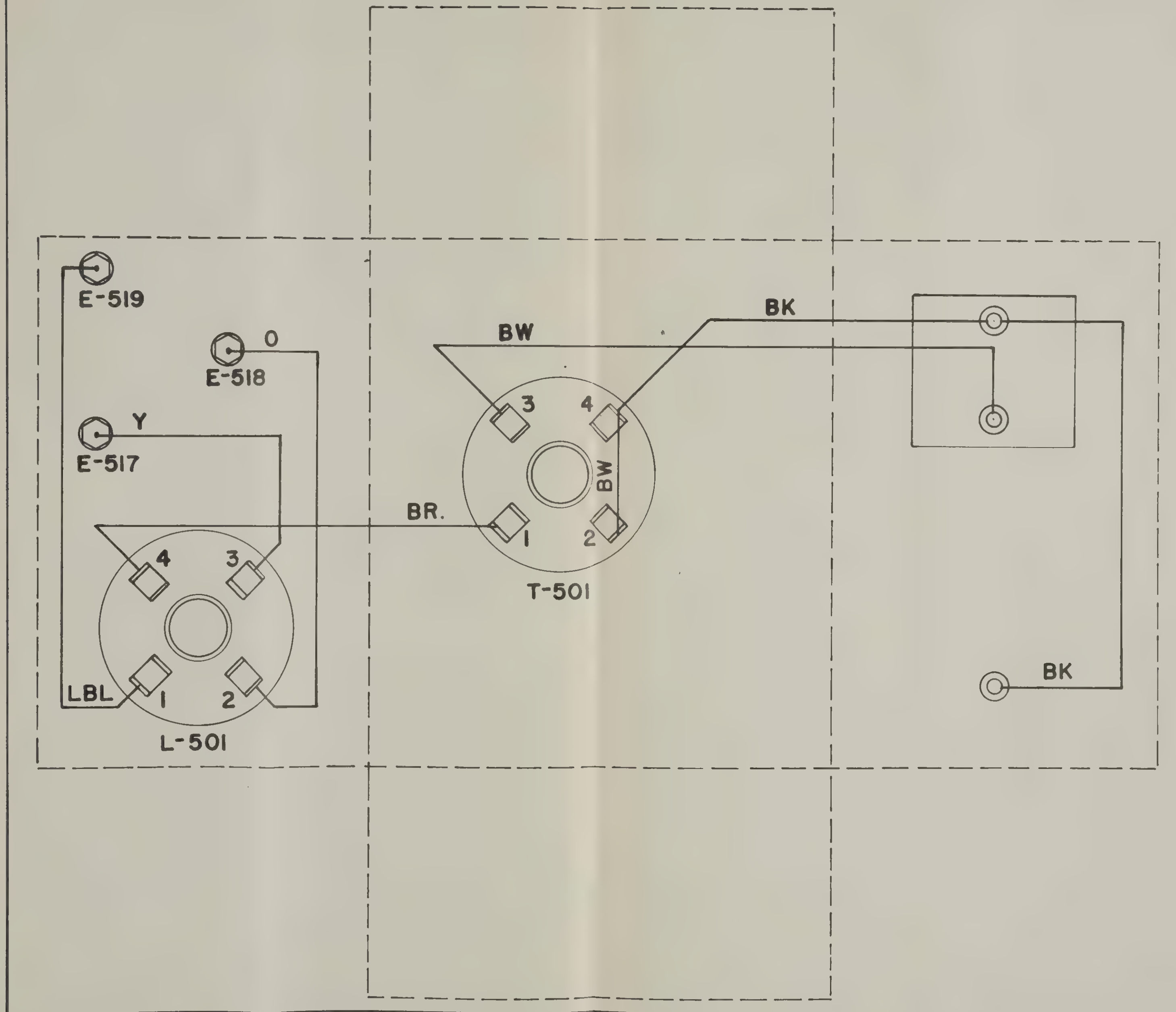
LEGEND

WIRE, STRANDED, PLASTIC INSULATION
NO BRAID, IN SIZES AND COLORS INDICATED
IN ACCORDANCE WITH JAN-C-76.

JAN TYPE SRIR-1(10)

BR	=	BROWN
BK	=	BLACK
LBL	=	LIGHT BLUE
Y	=	YELLOW
O	=	ORANGE
BW	=	#20 SOLID TINNED COPPER WIRE

Figure 7–46. Wiring Diagram, Antenna Coupler CU–155/U



LEGEND

WIRE, STRANDED, PLASTIC INSULATION NO BRAID, IN SIZES AND COLORS INDICATED IN ACCORDANCE WITH JAN-C-76.

JAN TYPE SRIR-1(10)

BR	=	BROWN
BK	=	BLACK
LBL	=	LIGHT BLUE
Y	=	YELLOW
O	=	ORANGE
BW	=	#20 SOLID TINNED COPPER WIRE

Figure 7–46. Wiring Diagram, Antenna Coupler CU–155/U

SECTION 8

PARTS LISTS

TABLE 8–1. WEIGHTS, SHIPPING WEIGHTS AND DIMENSIONS OF SPARE PARTS BOXES

EQUIPMENT	EQUIPMENT SPARES							STOCK SPARES						
	SHIP-PING BOX NO.	SPARE PARTS BOX	OVERALL DIMENSIONS			VOLUME	WEIGHT	SHIP-PING BOX NO.	SPARE PARTS BOX	OVERALL DIMENSIONS			VOLUME	WEIGHT
			HEIGHT	WIDTH	DEPTH					HEIGHT	WIDTH	DEPTH		
TS-318/UP	—	1	12	18 1/16	12	1.5	45	—	1	21	21	19 1/2	5.0	125
	*	—	14 3/4	24 1/4	14	2.9	80	*	—	24 1/4	24 3/4	22	7.6	200
TS-635/UP	—	1	12	18 1/16	12	1.5	45	—	1	21	21	19 1/2	5.0	125
	*	—	14 3/4	24 1/4	14	2.9	80	*	—	24 1/4	24 3/4	22	7.6	200

*Numbered in consecutive order beginning with 1.
Dimensions are inches, volume cubic feet, weight pounds.

TABLE 8–2. LIST OF MAJOR UNITS

SYMBOL	QUANTITY	NAME OF MAJOR UNIT	NAVY TYPE DESIGNATION	
			TS-318/UP	TS-635/UP
101-599	1	Field Intensity Meter (Including)	IM-10/UP	IM-14/UP
101-199		Sweep Generator Unit		
201-299		Cathode Ray Indicator Unit		
301-399		Receiver		
401-499		Signal Generator Unit		
501-599		Front Panel Components		
501-599	1	Antenna Coupler	CU-142/U	CU-155/U
601-699	1	Power Supply	PP-287/U	PP-287/U
....	1	Antenna Assembly	AS-377/U	AS-400/UP

TABLE 8-3. COMBINED PARTS AND SPARE PARTS LIST

PARTS											SPARE PARTS	
TS-635/UP	TS-318/UP	SYM. DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	JAN AND (NAVY TYPE) NO.	MFGR. AND MFGR'S. DESIGNATION	CONTRACTOR DRAWING & PART NO.	ALL SYM. DESIG. INVOLVED	TS-635/UP	TS-318/UP	EQUIP.	STOCK
			CAPACITORS									
x	x	C-101	CAPACITOR: Fixed; paper; 50,000 mmfd.; ±10%; 600 vdcw; $1\frac{5}{16}$" x $\frac{3}{4}$" x $1\frac{1}{16}$" h.; lug terminals; mounting brackets.	Plate coupling, V-101	CP61B1EF503K	1	50-168-115	C-101	1	1	1	3
x	x	C-102	CAPACITOR: Fixed; paper; 250,000 mmfd.; +40%, −15%; 400 vdcw; $1\frac{5}{16}$" x $\frac{3}{4}$" x $1\frac{3}{8}$" h.; lug terminals; mtg. bracket.	Grid by-pass V-101	CP61B1EE254K	1	50-167-118	C-102 C-114	2	2	1	5
x	x	C-103	CAPACITOR: Fixed; silvered mica; 2400 mmfd.; ±2%; 500 vdcw; $\frac{13}{16}$"x$\frac{13}{16}$"x$\frac{9}{32}$"; axial leads.	Screen-suppressor coupling, V-101	CM30E242G	2	50-169-112	C-103 C-104	2	2	1	2
x	x	C-104	Same as C-103.	Frequency circuit, V-101								
x	x	C-105	CAPACITOR: Fixed; mica; 10,000 mmfd.; ±10%; 300 vdcw; $\frac{13}{16}$" x $\frac{13}{16}$" x $\frac{11}{32}$"; axial leads.	Sweep capacitor, V-102	CM35B103K	3	50-136-115	C-105 thru C-109	5	5	2	9
x	x	C-106	Same as C-105.	Sweep capacitor, V-102								
x	x	C-107	Same as C-105.	Sweep capacitor, V-102								
x	x	C-108	Same as C-105.	Sweep capacitor, V-102								
x	x	C-109	Same as C-105.	Sweep capacitor, V-102								
x	x	C-110	CAPACITOR: Fixed; silvered mica; 3,000 mmfd.; ±2%; 500 vdcw; $\frac{13}{16}$" x $\frac{13}{16}$" x $\frac{9}{32}$"; axial leads.	Sweep capacitor, V-102	CM30E302G	2	50-170-112	C-110	1	1	1	1
x	x	C-111	CAPACITOR: Fixed; silvered mica; 1,000 mmfd.; ±2%; 500 vdcw; $\frac{13}{16}$" x $\frac{13}{16}$" x $\frac{9}{32}$"; axial leads.	Sweep capacitor, V-102	CM30E102G	2	50-171-112	C-111 C-112	2	2	1	2
x	x	C-112	Same as C-111.	Sweep capacitor, V-102								
x	x	C-113	CAPACITOR: Fixed; paper; 1.0 mfd.; +40%, −15%; 400 vdcw; $1\frac{15}{16}$" x $\frac{3}{4}$" x $2\frac{1}{2}$" h.; lug terminals; mtg. bracket.	Plate decoupling by-pass, V-101, V-102	CP61B1EE105X	1	50-178-118	C-113	1	1	1	3
x	x	C-114	Same as C-102.	Coupling V-102 to V-103								

x	x	C-115	CAPACITOR: Variable; ceramic dielectric; rotary single section; 20-125 mmfd.; 500 vdcw; negative temperature coefficient .00065 (±.0002) mmfd/mmfd/°C.	Frequency adjustment, V-101	CV12D121	4	50-203-1	C-115 C-116	2	2	1	2
x	x	C-116	Same as C-115.	Frequency adjustment, V-101								
x	x	C-117	*CAPACITOR: Fixed; mica; 150 mmfd.; ±10%; 500 vdcw; 25/32" x 15/32" x 7/32"; axial leads.	Frequency adj. padder, V-101	CM20B151K	1	50-204-115	C-117	1	1	1	1
			*CAPACITOR: Fixed; mica; 270 mmfd.; ±10%; 500 vdcw; 25/32" x 15/32" - 7/32"; axial leads.	Frequency adj. padder, V-101	CM20B271K	2	50-154-115	C-117	1	1	1	1
			*CAPACITOR: Fixed; mica; 390 mmfd.; ±10%; 500 vdcw; 25/32" x 15/32" - 7/32"; axial leads.	Frequency adj. padder, V-101	CM20B391K	1	50-179-115	C-117	1	1	1	1
x	x	C-201	CAPACITOR: Fixed; paper; 50,000 mmfd.; +40%, −15%; 1500 vdcw; 1" dia. x 1¾" long; axial leads; mounting bracket.	Decoupling by-pass 1000 V.	CP29A1EH503X	1	50-131-118	C-201 C-202 C-203	3	3	2	8
x	x	C-202	Same as C-201.	D.C. isolating, horizontal								
x	x	C-203	Same as C-201.	D.C. isolating, horizontal								
x	x	C-204	CAPACITOR: Fixed; mica; 4700 mmfd.; ±20%; 2,500 vdcw; 1⅝" x 1⅛" x 23/64"; 5/16" mounting holes 1 5/16" between centers.	D.C. isolating, vertical	CM50B472M	5	50-194-116	C-204 C-205 C-609	3	3	1	3
x	x	C-205	Same as C-204.	D.C. isolating, vertical								
x	x	C-206	CAPACITOR: Fixed; mica; 100 mmfd.; ±10%; 500 vdcw; 25/32" x 15/32" x 7/32"; axial leads.	R.F. by-pass, horizontal	CM20B101K	1	50-134-115	C-206 C-312	2	2	1	2
	x	C-301	CAPACITOR: Fixed; silvered mica; 39 mmfd.; ±5%; 500 vdcw; 25/32" x 15/32" x 7/32"; axial leads.	Antenna padder	CM20C390J	1	50-201-114	C-301 C-416	0	2	1	2
	x	C-302	CAPACITOR: Variable; air; 50 mmfd.; ⅞" long shaft; ⅜-32 threaded bushing.	Antenna trimmer	(−483202)	6 MC-50-S	50-156-101	C-302	0	1	0	1
x		C-302	CAPACITOR: Variable; air; 10 to 140 mmfd.; shaft ¼" dia. x ½" lg.	Antenna trimmer	(−481233)	6 MC-140-S	50-216-2	C-302	1	0	0	1
x		C-303	CAPACITOR: Variable; air; 3 section; 30 to 525 mmfd. per section; each section SLW; 0.0145" air gap; 3 15/32" lg. excluding shaft x 2 9/32" wide x 2½" high with plates fully unmeshed; round shaft ¼" dia. x ⅜" lg.; 180° ccw rotation; isolantite insulation.	Receiver tuning	(−484824)	7 Series 24, type H	50-213-2	C-303	1	0	0	1
x		C-303A	CAPACITOR: Variable; 30 to 525 mmfd.; part of C-303.	Tuning, RF amp., V-301								
x		C-303B	CAPACITOR: Variable; 30 to 525 mmfd.; part of C-303.	Tuning, mixer, V-302								

*Note: C-117—Only one alternate item used per unit. Value determined in production.

TABLE 8-3. COMBINED PARTS AND SPARE PARTS LIST (Continued)

PARTS											SPARE PARTS	
TS-635/UP	TS-318/UP	SYM. DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	JAN AND (NAVY TYPE) NO.	MFGR. AND MFGR'S. DESIGNATION	CONTRACTOR DRAWING & PART NO.	ALL SYM. DESIG. INVOLVED	TS-635/UP	TS-318/UP	EQUIP.	STOCK
x		C-303C	CAPACITOR: Variable; 30 to 525 mmfd.; part of C-303.	Tuning, oscillator, V-302								
	x	C-303	CAPACITOR: Variable; air; 3 section; 1st section, 11(±1) to 331.3 mmfd., 2nd and 3rd sections, 9(±1) to 132 mmfd.; *each section SLW; 0.0145" air gap; $3\frac{15}{32}$" lg. excluding shaft x $2\frac{9}{32}$" wide x $2\frac{1}{2}$" high, with plates fully unmeshed; round shaft $\frac{1}{4}$" dia. x $\frac{3}{8}$" lg.; 180° ccw rotation; isolantite insulation.	Receiver tuning	(−484742)	8 Model #24, Cat. #S3907-3-24 in accordance with WIT spec.	50-132-101	C-303	0	1	0	1
	x	C-303A	CAPACITOR: Variable; 11(±1) to 331.3 mmfd.; part of C-303.	Tuning, RF amp., V-301								
	x	C-303B	CAPACITOR: Variable; 9(±1) to 132 mmfd.; part of C-303.	Tuning, mixer, V-302								
	x	C-303C	CAPACITOR: Variable; 9(±1) to 132 mmfd.; part of C-303.	Tuning, oscillator, V-302								
x	x	C-304	CAPACITOR: Fixed; paper; 3 section; 50,000 mmf., +40%, −15% per section; 400 vdcw; $1\frac{3}{4}$" x $\frac{5}{8}$" x 1" high; bottom lug terminal; .14 mtg. holes, $2\frac{1}{8}$" between mtg./c.		CP69B5EE503X	9	50-145-118	C-304 C-413 C-414 C-415	4	4	2	10
x	x	C-304A	CAPACITOR: Fixed; paper; 50,000 mmfd.; 400 vdcw; part of C-304.	Cathode by-pass, V-301								
x	x	C-304B	CAPACITOR: Fixed; paper; 50,000 mmfd.; 400 vdcw; part of C-304.	Screen by-pass, V-301								
x	x	C-304C	CAPACITOR: Fixed; paper; 50,000 mmfd.; 400 vdcw; part of C-304.	Plate by-pass, V-301								
	x	C-305	CAPACITOR: Variable; air; single section; 6-26 mmfd.	Oscillator trimmer	(−484741)	10 ATR-5	50-155-1	C-305	0	1	1	1
x		C-305	CAPACITOR: Variable; air; 5.5 to 100 mmfd.	Oscillator trimmer	CT1B100	6 APC-100	50-212-209	C-305	1	0	0	0
x		C-306	CAPACITOR: Fixed; silvered mica; 100 mmfd.; ±5%; 500 vdcw; $\frac{25}{32}$" x $\frac{15}{32}$" x $\frac{7}{32}$"; axial leads.	Oscillator coupling	CM20C101J	1	50-097-204	C-306	1	0	1	1
	x	C-306	CAPACITOR: Fixed; silvered mica; 47 mmfd.; ±10%, 500 vdcw; $\frac{25}{32}$" x $\frac{15}{32}$" x $\frac{7}{32}$"; axial leads.	Oscillator coupling	CM20C470K	2	50-138-115	C-306	0	1	1	1

x	x	C-307	CAPACITOR: Fixed; paper; 3 section; 50,000 mmf., +40%, −15% per section; 400 vdcw; 1¾" x ⅝" x 1" h.; top lug terminals; 0.14 mtg. holes, 2⅛" between mtg./c.		CP67B5EE503X	9	50-152-118	C-307 C-308 C-309 C-310	4	4	2	10
x	x	C-307A	CAPACITOR: Fixed; paper; 50,000 mmf.; 400 vdcw; part of C-307.	Filament by-pass, V-302								
x	x	C-307B	CAPACITOR: Fixed; paper; 50,000 mmf.; 400 vdcw; part of C-307.	By-pass, grid V-302								
x	x	C-307C	CAPACITOR: Fixed; paper; 50,000 mmf.; 400 vdcw; part of C-307.	Plate by-pass, V-302								
x	x	C-308	Same as C-307.									
x	x	C-308A	Same as C-307A.	Cathode by-pass, V-303								
x	x	C-308B	Same as C-307B.	Screen grid by-pass, V-303								
x	x	C-308C	Same as C-307C.	Plate by-pass, V-303								
x	x	C-309	Same as C-307.									
x	x	C-309A	Same as C-307A.	Cathode by-pass, V-304								
x	x	C-309B	Same as C-307B	Screen by-pass, V-304								
x	x	C-309C	Same as C-307C.	Plate by-pass, V-304								
x	x	C-310	Same as C-307.									
x	x	C-310A	Same as C-307A.	Cathode by-pass, V-305								
x	x	C-310B	Same as C-307B.	Screen by-pass, V-305								
x	x	C-310C	Same as C-307C.	Plate by-pass, V-305								
x	x	C-311	CAPACITOR: Fixed; paper; 100,000 mfd.; −40%, −15%; 600 vdcw; 1¾" x ⅝" x 1" h.; top lug terminal; 0.14 mtg. holes 2⅛" between mtg./c.	Coupling, video output	CP67B1EE104X	1	50-144-118	C-311	1	1	1	3
x	x	C-312	Same as C-206	Cathode by-pass, V-306								
x		C-313	CAPACITOR: Fixed; silvered mica; 47 mmfd.; ±5%; 500 vdcw.	Fixed trimmer, oscillator	CM20C470J	1	50-138-204	C-313 C-314	1	0	1	2
x		C-314	Same as C-313.	Fixed trimmer mixer input								

TABLE 8-3. COMBINED PARTS AND SPARE PARTS LIST (Continued)

PARTS											SPARE PARTS	
TS-635/UP	TS-318/UP	SYM. DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	JAN AND (NAVY TYPE) NO.	MFGR. AND MFGR'S. DESIGNATION	CONTRACTOR DRAWING & PART NO.	ALL SYM. DESIG. INVOLVED	TS-635/UP	TS-318/UP	EQUIP.	STOCK
x		C-315	CAPACITOR: Variable; ceramic; 7 to 45 mmfd.	Oscillator padder	CV11C450	34 TS-2A, N500	50-223-2	C-315	1	0	1	1
x		C-316	CAPACITOR: Fixed; silvered mica; 470 mmfd., ±5%; 500 vdcw (part of Z-301)	Coupling, RF transformer	CM20C471J	1	50-108-204	C-316	1	0	0	0
	x	C-401	CAPACITOR: Fixed; silvered mica; 470 mmfd.; ±5%; 500 vdcw; 25/32" x 15/32" x 7/32"; axial leads.	Suppressor coupling, V-401	CM20C471J	1	50-149-114	C-401	0	1	1	3
x		C-401	CAPACITOR: Fixed; mica; 820 mmfd.; ±5%; 500 vdcw.	Suppressor grid coupling, V-401	CM25B821J	1	50-226-104	C-401	1	0	1	1
x	x	C-402	CAPACITOR: Fixed; mica; 10,000 mmfd.; ±20%; 300 vdcw; 13/16"x13/16"x11/32"; axial leads.	Output coupling, V-401	CM35B103M	1	50-136-116	C-402 C-407 C-408 C-409	4	4	*	*
x	x	C-403	CAPACITOR: Fixed; paper; 500,000 mmfd.; +40%, −15%; 400 vdcw; 1 13/16" x 1" x 7/8" h.; top lug terminal; 3/16" mtg. holes, 1 1/8" between mtg./c.	Plate by-pass, V-402	CP51B1EE504X	1	50-181-118	C-403 C-406 C-412	3	3	2	8
x		C-404	CAPACITOR: Fixed; mica; 270 mmfd.; ±5%; 500 vdcw; 25/32" x 15/32" x 17/32"; axial leads.	Grid blocking, V-402	CM20B271J	1	50-154-104	C-404	1	0	1	1
	x	C-404	CAPACITOR: Fixed; mica; 24 mmfd.; ±5%; 500 vdcw; 25/32" x 15/32" x 7/32"; axial leads.	Grid blocking, V-402	CM20B240J	1	50-180-114	C-404	0	1	1	1
	x	C-405	CAPACITOR: Variable; air; single section; 9-140 mmfd.	Oscillator tuning, V-402	(−484740)	6 MC-140-M	50-148-101	C-405	0	1	0	1
x		C-405	CAPACITOR: Variable; air; single section; 12 to 260 mmfd.	Oscillator tuning, V-402	(−482437)	6 MC-250-M	50-208-2	C-405	1	0	0	1
x	x	C-406	Same as C-403.	Diode by-pass, V-403								
x	x	C-407	Same as C-402.	RF coupling, VTVM								
x	x	C-408	Same as C-402.	RF coupling, attenuator								
x	x	C-409	Same as C-402.	RF by-pass, VTVM								

x		C-410	CAPACITOR: Fixed, mica; 470 mmfd.; ±20%; 500 vdcw.	RF by-pass, sync.	CM20B471M	1	50-149-116	C-410 C-411	2	0	1	2
	x	C-410	CAPACITOR: Fixed; mica; 470 mmfd.; ±20%; 500 vdcw; 25/32" x 15/32" x 7/32"; axial leads.	RF by-pass, sync.	CM20B471M	1	50-149-116	C-410 C-411	0	2	**	**
x	x	C-411	Same as C-410.	RF by-pass, sync.								
x	x	C-412	Same as C-403.	RF by-pass, heater								
x	x	C-413	Same as C-304.									
x	x	C-413A	Same as C-304A.	RF by-pass, meter neg.								
x	x	C-413B	Same as C-304B.	RF by-pass, meter pos.								
x	x	C-413C	Same as C-304C.	RF by-pass, 150 V.								
x	x	C-414	Same as C-304.									
x	x	C-414A	Same as C-304A.	RF by-pass, zero adj.								
x	x	C-414B	Same as C-304B.	RF by-pass, zero adj.								
x	x	C-414C	Same as C-304C.	RF by-pass, zero adj.								
x	x	C-415	Same as C-304.									
x	x	C-415A	Same as C-304A.	RF by-pass, 150 V.								
x	x	C-415B	Same as C-304B.	RF by-pass, meter pos.								
x	x	C-415C	Same as C-304C.	RF by-pass, meter neg.								
x		C-416	CAPACITOR: Fixed; silvered mica; 39 mmf.; ±5%; 500 vdcw; 25/32" x 15/32" x 7/32"; axial leads.	Frequency compensation	CM20C390J	1	50-201-114	C-416	1	0	1	1
	x	C-416	Same as C-301.	Frequency compensation								
	x	C-417	CAPACITOR: Fixed; paper; 100,000 mmfd.; −40%, −15%; 500 vdcw; 11/16" dia. x 1 3/16" lg.; axial leads.	RF by-pass, VTVM	CP29A2EE104X	11	50-202-118	C-417	0	1	1	3
x		C-417	CAPACITOR: Fixed; paper; 1.0 mfd.; +40%, −15%; 200 vdcw; tubular metal case; hermetically sealed.	"RF Level" meter by-pass	(−484823)	9 SL "Solite"	50-225-208	C-417	1	0	1	3
x		C-418	CAPACITOR: Fixed; mica; 1600 mmfd.; ±5%; 500 vdcw.	Suppressor coupling, V-401	CM30B162J	1	50-228-114	C-418	1	0	1	1

*Note: ±10% capacitors—same as C-105, supplied as spares.

**Note: ±5% capacitors—same as C-401, supplied as spares.

TABLE 8-3. COMBINED PARTS AND SPARE PARTS LIST (Continued)

PARTS											SPARE PARTS	
TS-635/UP	TS-318/UP	SYM. DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	JAN AND (NAVY TYPE) NO.	MFGR. AND MFGR'S. DESIGNATION	CONTRACTOR DRAWING & PART NO.	ALL SYM. DESIG. INVOLVED	TS-635/UP	TS-318/UP	EQUIP.	STOCK
x		C-419	CAPACITOR: Fixed; mica; 3300 mmfd.; ±5%; 500 vdcw.	Suppressor coupling, V-401	CM30B332J	9	50-113-114	C-419	1	0	1	1
x		C-420	CAPACITOR: Fixed; mica; 5700 mmfd.; ±5%; 500 vdcw.	Suppressor coupling, V-401	CM35B512J	9	50-227-114	C-420	1	0	1	1
	x	C-501	CAPACITOR: Fixed; mica; 1000 mmf.; ±5%; 500 vdcw; $\frac{13}{16}$" x $\frac{13}{16}$" x $\frac{9}{32}$"; axial leads.	Padder, CU-142/U	CM30B102J	2	50-171-114	C-501	0	1	0	0
x	x	C-601	CAPACITOR: Fixed; paper; dual section; 100,000 mmfd.; +40%, −15%; 600 vdcw; $1\frac{3}{16}$" x 1" x $\frac{3}{4}$" h.; side lug terminals; $\frac{3}{16}$" mtg. holes $2\frac{1}{8}$" between mtg./c.	RF filter, 115 V. line	CP53B4EF104L	12	50-196-119	C-601	1	1	1	3
x	x	C-602	CAPACITOR: Fixed; paper; 500,000 mmfd.; +20%, −10%; 600 vdcw; $1\frac{3}{4}$" x $\frac{5}{8}$" x $1\frac{15}{16}$" h.; bottom lug terminals; 0.14" dia. mtg. holes $2\frac{1}{8}$" between mtg./c.	Hash filter by-pass	CP69B1FF504V	13	50-185-117	C-602 C-603	2	2	1	5
x	x	C-603	Same as C-602.	Hash filter by-pass								
x	x	C-604	CAPACITOR: Fixed; paper; 6000 mmfd.; ±10%; 1500 vdcw; $\frac{11}{16}$" dia. x $\frac{11}{16}$" lg.; axial leads.	Buffer capacitor transformer sec.	CP29A1EH602K	5	50-162-115	C-604	1	1	1	3
x	x	C-605	CAPACITOR: Fixed; paper; 10 mfd.; +40%, −15%; 600 vdcw; $3\frac{3}{4}$" x $1\frac{1}{4}$" x $4\frac{3}{4}$" h.; lug terminals; spade brackets.	Filter, 250 V.	CP70B1DF106X	1	50-142-118	C-605 C-607	2	2	1	5
x	x	C-606	CAPACITOR: Fixed; paper; 500,000 mmfd.; −40%, −15%; 1500 vdcw; $1\frac{1}{2}$" dia. x $2\frac{3}{8}$" h.; lug terminals; $\frac{3}{4}$-16 bushing.	Filter, 1000 V.	CP41B1EH504X	1	50-143-118	C-606	1	1	1	3
x	x	C-607	Same as C-605.	Filter, 250 V.								
x	x	C-608	CAPACITOR: Fixed; paper; 100,000 mmfd.; +40%, −15%; 600 vdcw; $1\frac{13}{16}$" x 1" x $\frac{3}{4}$" h.; lug terminals; $\frac{3}{16}$" mtg. holes $2\frac{1}{8}$" between mtg./c.	RF filter, 250 V.	CP54B1FF104X	1	50-197-118	C-608	1	1	1	3
x	x	C-609	Same as C-204.	RF filter, 1000 V.								

MISCELLANEOUS ELECTRICAL PARTS

x	x	E-101	BOARD, Terminal, 8 terminals.	Sweep Generator Unit Connections		14 21040-1	21040-1	E-101	1	1	0	0
x	x	E-102 thru E-200	Not used.									
x	x	E-201	BOARD, Terminal, 7 terminals.	Cathode Ray Indicator Connections		14 11856-1	11856-1	E-201	1	1	0	0
x	x	E-202 thru E-300	Not used.									
x	x	E-301	BOARD, Terminal, 3 terminals.	Receiver Connections		14 20961-1	20961-1	E-301	1	1	0	0
x	x	E-302 thru E-400	Not used.									
x	x	E-401	BOARD, Terminal, 4 terminals.	Signal Generator Unit Connections		14 11827-1	11827-1	E-401	1	1	0	0
x	x	E-402	BOARD, Terminal, 6 terminals.	Signal Generator Unit "O Adj" and "Sync" Connections		14 11944-1	11944-1	E-402	1	1	0	0
x	x	E-403 thru E-500	Not used.									
x	x	E-501	BOARD, Terminal.			14 11527-1	11527-1	E-501	1	1	0	0
x	x	E-502 thru E-513	KNOB: Fluted; black phenolic plastic for ¼" dia. shaft; double #8-32 Allen set screw; white marker; skirt 1½" dia. x 3/16" deep; brass sleeve insert.	Control knobs		15 7104	140-026-2	E-502 thru E-513	12	12	0	12
x	x	E-514 and E-515	Not used.									
x	x	E-516	POST: Binding; marked "GND"; spring action, mounts by 6-32 threaded shaft.	Ground terminal Antenna coupler		16 #7808	70-042-2	E-516	1	1	1	2
x	x	E-517	POST: Binding; marked "Al"; spring action, mounts by 6-32 threaded shaft.	Antenna term., Antenna coupler		16 #63KB	70-020-2	E-517	1	1	0	0

TABLE 8-3. COMBINED PARTS AND SPARE PARTS LIST (Continued)

PARTS											SPARE PARTS	
TS-635/UP	TS-318/UP	SYM. DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	JAN AND (NAVY TYPE) NO.	MFGR. AND MFGR'S. DESIGNATION	CONTRACTOR DRAWING & PART NO.	ALL SYM. DESIG. INVOLVED	TS-635/UP	TS-318/UP	EQUIP.	STOCK
x	x	E-518	POST: Binding; marked "A2"; spring action, mounts by 6-32 threaded shaft.	Antenna term., Antenna coupler		16 #63KB	70-021-2	E-518	1	1	0	0
x	x	E-519	POST: Binding; marked "A3"; spring action, mounts by 6-32 threaded shaft.	Antenna term., Antenna coupler		16 #63KB	70-045-2	E-519	1	1	0	0
x	x	E-520 thru E-600	Not used.									
x	x	E-601	HOLDER: Fuse; finger operated; for type 3GA fuse.			17 342001	70-036-101	E-601 E-602 E-603 E-604	4	4	1	4
x	x	E-602	Same as E-601.									
x	x	E-603	Same as E-601.									
x	x	E-604	Same as E-601.									
x	x	E-605	CLIP: Vacuum tube plate.	Plate connector V-601		18 SPP-3	140-006-1	E-605	1	1	0	1
x	x	E-606	CLIP: Battery; marked "+" (part of W-506).	External battery lead		44 #21A	140-056-2	E-606	1	1	0	0
x	x	E-607	CLIP: Battery (part of W-507).	External battery lead		44 #21A	140-057-2	E-607	1	1	0	0
x	x	E-608	INSULATOR: Battery clip, red (part of W-506).			44 #23	140-058-2	E-608	1	1	0	0
x	x	E-609	INSULATOR: Battery clip, black (part of W-507).			44 #23	140-059-2	E-609	1	1	0	0
FUSES												
x	x	F-601	FUSE: 10.0 ampere; 25 volts; 3AG; ¼" dia. x 1¼" lg.	Battery supply	(−28030-10)	17 1081	70-043-1	F-601 F-602	2	2	20	100
x	x	F-602	Same as F-601.	Battery supply								
x	x	F-603	FUSE: 1.0 ampere; 250 volts; 3AG; ¼" dia. x 1¼" lg.	115 VAC line	(−28Q32-1)	17 1040	70-038-1	F-603 F-604	2	2	40	200
x	x	F-604	Same as F-603.	115 VAC line								

HARDWARE

x	x	H-101 thru H-103	Not used.									
x	x	H-104	SHIELD: Miniature tube; 7/8" dia. x 1 3/8" lg.	Shielding, V-101	SOS3	16	140-011-1	H-104 thru H-107	4	4	1	11
x	x	H-105	Same as H-104.	Shielding, V-102								
x	x	H-106	Same as H-104.	Shielding, V-103								
x	x	H-107	Same as H-104.	Shielding, V-104								
x	x	H-301	Same as H-104.	Shielding, V-301								
x	x	H-302	Same as H-104.	Shielding, V-303								
x	x	H-303	Same as H-104.	Shielding, V-304								
x	x	H-304	Same as H-104.	Shielding, V-305								
x	x	H-305	SHIELD: Miniature tube; 7/8" dia. x 1 3/4" lg.	Shielding, V-306	SOS6	16	140-012-1	H-305	1	1	1	1
x	x	H-401	Same as H-104.	Shielding, V-401								
x	x	H-402	Same as H-104.	Shielding, V-402								
x	x	H-403	Same as H-104.	Shielding, V-403								
x	x	H-404	CLAMP: Tube.	Clamp, V-404	(−49496)	19 926A-14	140-004-201	H-404 H-608	2	2	1	2
x	x	H-501 thru H-509	Not used.									
x	x	H-510	LOCK: Dial; nickel-plated spring brass.			14 11736	140-039-201	H-510	1	1	0	2
x	x	H-511 and H-512	Not used.									
x	x	H-513	EYE SHIELD.			14 21031-1	21031-1	H-513	1	1	1	0
x	x	H-514	Not used.									
x	x	H-515	WRENCH: Allen type; hexagonal; for #8 set screw, SAE 150 steel, Rockwell hardness C47-52.			20	140-042-2	H-515	1	1	1	2
x	x	H-516	WRENCH: Allen type; hexagonal; for #6 set screw; SAE 150 steel, Rockwell hardness C47-52.			20	140-041-2	H-516	1	1	1	2

TABLE 8-3. COMBINED PARTS AND SPARE PARTS LIST (Continued)

PARTS											SPARE PARTS	
TS-635/UP	T-S318/UP	SYM. DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	JAN AND (NAVY TYPE) NO.	MFGR. AND MFGR'S. DESIGNATION	CONTRACTOR DRAWING & PART NO.	ALL SYM. DESIG. INVOLVED	TS-635/UP	TS-318/UP	EQUIP.	STOCK
x	x	H-517	WRENCH: Spanner.			14 11950-1	11950-1	H-517	1	1	1	2
x	x	H-518	Not used.									
x	x	H-519	WASHER: Neoprene.	Cathode Ray Tube Shield		14 11380-1	11380-1	H-519	1	1	1	4
x	x	H-601 thru H-607	Not used.									
x	x	H-608	Same as H-404.	Clamp, V-603								
x	x	H-609	CLAMP: Tube.	Clamp, V-601	(−491823)	19 926B-16	140-003-201	H-609	1	1	1	1
x	x	H-610	CLAMP: Tube.	Clamp, V-602	(−491822)	19 926B-31	140-002-201	H-610	1	1	1	1
x	x	H-611	Not used.									
x	x	H-612	CLAMP: cable; with #9769-12 ferrule; (part of W-505).		AN-30-57-12	21	140-007-1	H-612 H-613	2	2	0	0
x	x	H-613	Same as H-612; (part of W-505).									
			JACKS AND RECEPTACLES									
x	x	J-101 thru J-400	Not used.									
x	x	J-401A	JACK: Banana.	Ext. VTVM		14 11522-1	11522-1	J-401A J-401B	2	2	1	4
x	x	J-401B	Same as J-401A.	Ext. VTVM								
x	x	J-402 thru J-500	Not used.									
x	x	J-501	RECEPTACLE: 6 contact; male.	Interunit power cable connector	AN-3102-22-24P	21	75-022-101	J-501	1	1	1	2

x	x	J-502	RECEPTACLE: Phone jack; single break circuit.	"Video Output"	(−49025-A)	22 IJ-106	75-020-201	J-502	1	1	1	2
x	x	J-503	RECEPTACLE: Phone jack; "make before break" circuit.	"Ext. Sync."	(−491821)	22 SJ-63	75-024-201	J-503	1	1	1	2
x	x	J-601	RECEPTACLE: 2 pole; male; 110 VAC.	Power	(−491108)	23 4891	75-023-101	J-601	1	1	1	2
x	x	J-602	RECEPTACLE: 6 contact; female.	Interunit power cable connector	AN-3102-22-24S	21	75-021-101	J-602	1	1	1	2
			INDUCTORS, RF AND AF									
x	x	L-401	INDUCTOR: RF; 2.5 millihenry.	RF filter, 150 V.	(−472175)	10 13666F	85-039-101	L-401 L-402 L-403 L-404	4	4	1	12
x	x	L-402	Same as L-401.	RF filter, zero adjustment								
x	x	L-403	Same as L-401.	RF filter, meter negative								
x	x	L-404	Same as L-401.	RF filter, meter positive								
x	x	L-405	INDUCTOR: RF; 50 microhenries; 0.75 amp. DC; DC resistance 0.2 ohms.	RF filter, heater	(−472172)	24	85-053-101	L-405	1	1	1	3
	x	L-501	COIL: Antenna series.	Loading coil, CU-142/U	(−472177)	14 21091-1	21091-1	L-501	0	1	0	0
x		L-501	COIL: Antenna series.	Loading coil, CU-155/U	(−472285)	14 21178-1	21178-1	L-501	1	0	0	0
x	x	L-601	INDUCTOR: RF; 0.3 millihenry; 0.5 amp.; DC resistance 2.5 ohms.	RF filter, 115 VAC	(−472171)	24	85-047-101	L-601 L-602	2	2	1	6
x	x	L-602	Same as L-601	RF filter, 115 VAC								
x	x	L-603	INDUCTOR: AF; 72 microhenries at 1000 cycles; iron core.	Hash filter	(−472170)	14 85-052	85-052	L-603	1	1	1	3
x	x	L-604	INDUCTOR: Filter; 15 henries; 75 ma. DC.	Filter, 250 V.	(−303952)	25	85-038-1	L-604	1	1	1	3
x	x	L-605	INDUCTOR: RF; 1.0 millihenry; 70 ma.; DC resistance 25 ohms.	RF filter, 250 V.	(−471474)	10	85-051-101	L-605 L-606	2	2	1	6
x	x	L-606	Same as L-605.	RF filter, 1000 V.								

TABLE 8-3. COMBINED PARTS AND SPARE PARTS LIST (Continued)

TS-635/UP	TS-318/UP	SYM. DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	JAN AND (NAVY TYPE) NO.	MFGR. AND MFGR'S. DESIGNATION	CONTRACTOR DRAWING & PART NO.	ALL SYM. DESIG. INVOLVED	TS-635/UP	TS-318/UP	SPARE PARTS EQUIP.	SPARE PARTS STOCK
			METERS									
x	x	M-501	METER: Milliammeter; DC; 0-1 ma.	Receiver output and voltmeter, "CW" and "Test"	MR35W001DCMA	26	90-007-1	M-501	1	1	1	0
x	x	M-502	METER: Microammeter; DC; 0-200 microamperes.	Bridge balance "RF Level"	MR35W200DCUA	26	90-008-1	M-502	1	1	1	0
			DIALS									
x	x	N-501	DIAL: 4" diameter; calibrated 0-100 in 180 degrees.	Tuning dial		27	140-023-2	N-501 N-502	2	2	0	2
x	x	N-502	Same as N-501.	Tuning dial								
x	x	N-503	DIAL: 2" diameter; calibrated 0-100 in 270 degrees.	"Specific PRR"		14 12020-1	12020-1	N-503	1	1	0	1
			MECHANICAL PARTS									
x	x	O-301	DRIVE: Dial; planetary; 5 to 1 reduction.	Tuning reduction		27	140-022-2	O-301 O-401	2	2	1	2
x	x	O-302	COUPLING: Flexible; ceramic; for ¼" shafts; two Allen set screws each side.	Variable capacitor coupling		28 #250	140-044-101	O-302 O-402	2	2	0	3
x	x	O-401	Same as O-301.	Tuning reduction								
x	x	O-402	Same as O-302.	Variable capacitor coupling								
			PLUGS									
x	x	P-501	PLUG: Miniature; "banana".	Loop ant. plug		28 #79	95-023-001	P-501	1	1	1	0
x	x	P-502	PLUG: Miniature; "banana".	Loop ant. plug		28 #80A	95-024-001	P-502	1	1	1	0

x	x	P-503	PLUG, telephone: 2 cond.; single shank; tubular, black moulded bakelite shell; shell dia. ¾"; overall length 2¾"; either lug or phone tip connections; part of W-503.		(−49006A)	42 #75	95-022-2	P-503 P-504	2	2	0	0
x	x	P-504	Same as P-503; part of W-504.									
x	x	P-601	PLUG: 1 contact; male; "banana" type.	Internal battery plug		28 #75A	95-028-101	P-601	1	1	1	4
x	x	P-602	PLUG: 2 contact; male, part of W-508.	115 VAC plug	(−49825)	23 7057	95-025-201	P-602	1	1	1	2
x	x	P-603	PLUG: 2 contact; female, part of W-508.	115 VAC plug	(−491077)	23 7084	95-026-201	P-603	1	1	1	2
x	x	P-604	CONNECTOR, male contact: 6 round contacts; 90° angle type; part of W-505.		AN-3108-22-24P	21	95-020-101	P-604	1	1	0	0
x	x	P-605	CONNECTOR, female contact: 6 round contacts; straight type; part of W-505.		AN-3106-22-24S	21	95-021-101	P-605	1	1	0	0
			RESISTORS									
x	x	R-101	RESISTOR: Fixed; comp.; 4.7 meg.; ±10%; ½ w.; 0.249" dia. x 0.655" lg.; leads 1½" lg.	Grid resistor V-101	RC21BF475K	30	100-166-114	R-101 R-114 R-119	3	3	*	*
x	x	R-102	RESISTOR: Fixed; comp.; 1500 ohms; ±5%; ½ w.; 0.249" dia. x 0.655" lg.; leads 1½" lg.	Cathode resistor, V-101	RC21BF152J	30	100-258-114	R-102 R-401	2	2	1	10
x	x	R-103	RESISTOR: Fixed; comp.; 51,000 ohms; ±5%; ½ w.; 0.249" dia. x 0.655" lg.; leads 1½" lg.	Output divider, V-101	RC21BF513J	32	100-249-114	R-103 R-106	2	2	1	10
x	x	R-104	RESISTOR: Fixed; comp.; 3900 ohms; ±5%; ½ w.; 0.249" dia. x 0.655" lg.; leads 1½" lg.	Output divider, V-101	RC21BF392J	31	100-211-114	R-104	1	1	1	5
x	x	R-105	RESISTOR: Fixed; comp.; 75,000 ohms; ±5%; ½ w.; 0.249" dia. x 0.655" lg.; leads 1½" lg.	Plate resistor, V-101	RC21BF753J	32	100-165-114	R-105	1	1	1	10
x	x	R-106	Same as R-103.	Screen resistor, V-101								
x	x	R-107	RESISTOR: Variable; wire wound; 15,000 ohms; ±10%; .4 w.; body 1.79" dia. x 0.98"; shaft ⅞" lg. including bushing ⅜" lg.	Frequency circuit, V-101	RA30A1RD153AK	33	100-219-115	R-107 R-108 R-302	3	3	2	15
x	x	R-108	Same as R-107.	Frequency circuit, V-101								
x	x	R-109	RESISTOR: Fixed; wire wound; 300,000 ohms; ±1%; hermetically sealed; ⅞" dia. x 1¼" lg.; solder lug terminals; 6-32 mtg. screw.	Frequency circuit, V-101	RB13B30002F	29 1196	100-261-111	R-109 R-110	2	2	1	10
x	x	R-110	Same as R-109.	Frequency circuit, V-101								

*Note: ±5% resistors—same as R-204, supplied as spares.

TABLE 8-3. COMBINED PARTS AND SPARE PARTS LIST (Continued)

PARTS											SPARE PARTS	
TS-635/UP	TS-318/UP	SYM. DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	JAN AND (NAVY TYPE) NO.	MFGR. AND MFGR'S. DESIGNATION	CONTRACTOR DRAWING & PART NO.	ALL SYM. DESIG. INVOLVED	TS-635/UP	TS-318/UP	EQUIP.	STOCK
x	x	R-111	RESISTOR: Fixed; comp.; 100,000 ohms; ±10%; ½ w.; —.249″ dia. x 0.655″ lg.; leads 1½″ lg.	Grid resistor, V-102	RC21BF104K	30	100-169-115	R-111 R-334 R-336 R-402	4	4	*	*
x	x	R-112	RESISTOR: Fixed; comp.; 2000 ohms; ±5%; ½ w.; 0.249″ diam. x 0.655″ long; leads 1½″ long.	Cathode resistor, V-102	RC21BF202J	30	100-296-114	R-112	1	1	1	5
x	x	R-113	RESISTOR: Fixed; comp.; 130,000 ohms; ±5%; ½ w.; 0.249″ diam. x 0.655″ long; leads 1½″ long.	Screen resistor, V-102	RC21BF134J	31	100-216-114	R-113 R-301 R-315	3	3	2	15
x	x	R-114	Same as R-101.	Suppressor resistor, V-102								
x	x	R-115	RESISTOR: Variable; comp.; 2.5 megohm; ±10%; 2 w.; linear taper; body 1 1/16″ diam. x 7/16″ deep; shaft 5/8″ long including bushing 3/8″ long.	Suppressor resistor, V-102	(—636723-M10)	30	100-267-105	R-115	1	1	1	5
x	x	R-116	RESISTOR: Fixed; comp.; 220,000 ohms; ±10%; ½ w.; 0.249″ diam. x 0.655″ long; leads 1½″ long.	Plate resistor, V-102	RC21BF224K	30	100-302-115	R-116 R-201	2	2	1	10
x	x	R-117	RESISTOR: Fixed; comp.; 1.8 megohm; ±10%; ½ w.; 0.249″ diam. x 0.655″ long; leads 1½″ long.	Plate resistor, V-102	RC21BF185K	30	100-307-115	R-117	1	1	1	5
x	x	R-118	RESISTOR: Fixed; comp.; 7500 ohms; ±10%; ½ w.; 0.249″ diam. x 0.655″ long; leads 1½″ long.	Decoupling, 150 V.	RC21BF752K	31	100-265-115	R-118	1	1	1	5
x	x	R-119	Same as R-101.	Grid resistor, V-103								
x	x	R-120	RESISTOR: Fixed; comp.; 47,000 ohms; ±10%; ½ w.; 0.249″ diam. x 0.655″ long; leads 1½″ long.	Plate resistor, V-103	RC21BF473K	32	100-240-115	R-120	1	1	1	5
x	x	R-121	RESISTOR: Fixed; comp.; 470,000 ohms; ±10%; ½ w.; 0.249″ diam. x 0.655″ long; leads 1½″ long.	Plate resistor, V-104	RC21BF474K	30	100-299-115	R-121 R-437	2	2	1	10
x	x	R-122	RESISTOR: Fixed; comp.; 2700 ohms; ±5%; ½ w.; 0.249″ diam. x 0.655″ long; leads 1½″ long.	Cathode resistor, V-103	RC21BF272J	30	100-298-114	R-122	1	1	1	5

x	x	R-201	Same as R-116.	Decoupling, 1000 V.								
x	x	R-202	RESISTOR: Variable; comp.; 750,000 ohms; ±10%; 0.4 w.; linear taper; body 1¼″ diam. x 9/16″ deep; insulated shaft 1¼″ long including bushing ⅜″ long; friction rotor; water-proof.	"Horizontal Centering" control	(−636827-R10)	31 Type MG	100-189-105	R-202 R-203	2	2	1	10
x	x	R-203	Same as R-202.	"Vertical Centering" control								
x	x	R-204	RESISTOR: Fixed; comp.; 4.7 megohm; ±5%; ½ w.; 0.249″ diam. x 0.655″ long; leads 1½″ long.	Isolating resistor	RC21BF475J	30	100-166-114	R-204 thru R-211	8	8	2	55
x	x	R-205	Same as R-204.	Horizontal centering network								
x	x	R-206	Same as R-204.	Horizontal centering network								
x	x	R-207	Same as R-204.	Isolating resistor								
x	x	R-208	Same as R-204.	Isolating resistor								
x	x	R-209	Same as R-204.	Vertical centering network								
x	x	R-210	Same as R-204.	Vertical centering network								
x	x	R-211	Same as R-204.	Isolating resistor								
x	x	R-212	RESISTOR: Fixed; comp.; 100,000 ohms; ±5%; ½ w.; 0.249″ diam. x 0.655″ long; leads 1½″ long.	Isolating resistor	RC21BF104J	30	100-169-114	R-212	1	1	2	25
x	x	R-213	RESISTOR: Variable; comp.; 500,000 ohms; ±10%; 0.4 w.; linear taper; body 1¼″ diam. x 9/16″ deep; sealed shaft ⅞″ long including bushing ⅜″ long; water-proof.	Voltage control, Anode #1, V-201 "Focusing"	(−632433-N10)	31 Type MG	100-206-101	R-213	1	1	1	5
x	x	R-214	RESISTOR: Fixed; comp.; 330,000 ohms; ±10%; ½ w.; 0.249″ diam. x 0.655″ long; leads 1½″ long.	High voltage bleeder	RC21BF334K	34	100-193-115	R-214 R-337	2	2	1	10
x	x	R-215	RESISTOR: Fixed; comp.; 10,000 ohms; ±10%; ½ w.; 0.249″ diam. x 0.655″ long; leads 1½″ long.	High voltage bleeder	RC21BF103K	30	100-173-115	R-215 R-332	2	2	1	10
x	x	R-216	RESISTOR: Variable; comp.; 250,000 ohms; ±10%; 0.4 w.; linear taper; body 1¼″ diam. x 9/16″ deep; sealed shaft ⅞″ long including bushing ⅜″ long; water-proof.	Cathode bias control, V-201 "Intensity"	(−636826-N10)	31	100-190-105	R-216	1	1	1	5

*Note: ±5% resistors—same as R-212 supplied as spares.

TABLE 8-3. COMBINED PARTS AND SPARE PARTS LIST (Continued)

PARTS											SPARE PARTS	
TS-635/UP	TS-318/UP	SYM. DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	JAN AND (NAVY TYPE) NO.	MFGR. AND MFGR'S. DESIGNATION	CONTRACTOR DRAWING & PART NO.	ALL SYM. DESIG. INVOLVED	TS-635/UP	TS-318/UP	EQUIP.	STOCK
x	x	R-301	Same as R-113.	Grid resistor, V-301								
x	x	R-302	Same as R-107.	Variable bias, V-301								
x	x	R-303	RESISTOR: Fixed; comp.; 470 ohms; ±10%; ½ w.; 0.249″ diam. x 0.655″ long; leads 1½″ long.	Cathode resistor, V-303	RC21BF471K	30	100-227-115	R-303 R-318 R-323 R-328 R-408	5	5	2	25
x	x	R-304	RESISTOR: Fixed; comp.; 100,000 ohms; ±10%; 1 w.; 0.31″ diam. x 1.28″ long; leads 1½ long.	Bleeder, 250 V.	RC31BF104K	30	100-308-115	R-304	1	1	1	5
x	x	R-305	RESISTOR: Fixed; comp.; 39,000 ohms; ±5%; ½ w.; 0.249″ diam. x 0.655″ long; leads 1½″ long.	Screen resistor, V-301	RC21BF393J	30	100-257-114	R-305	1	1	1	5
	x	R-306	RESISTOR: Fixed; comp.; 4700 ohms; ±10%; ½ w.; 0.249″ diam. x 0.655″ long; leads 1½ long.	Plate resistor, V-301	RC21BF472K	32	100-171-115	R-306	0	1	1	5
	x	R-307	RESISTOR: Fixed; comp.; 22,000 ohms; ±10%; ½ w.; 0.249″ diam. x 0.655″ long; leads 1½ long.	#1 grid resistor, V-302	RC21BF223K	32	100-195-115	R-307 R-333	0	2	1	10
x		R-307	RESISTOR: Fixed; comp.; 18,000 ohms; ±10%; ½ w.; 0.249″ diam. x 0.655″ long; leads 1½″ long.	#1 grid resistor, V-302	RC21BF183K	30	100-309-105	R-307	1	0	0	*5
x	x	R-308	RESISTOR: Fixed; comp.; 18,000 ohms; ±5%; ½ w.; 0.249″ diam. x 0.655″ long; leads 1½ long.	Bleeder, 250 V.	RC21BF183J	30	100-309-114	R-308	1	1	1	5
x	x	R-309	RESISTOR: Fixed; comp.; 4700 ohms; ±5%; 2 w.; 0.405″ diam. x 1.41″ long; leads 1½″ long.	Bleeder, 250 V.	RC40BE472J	30	100-210-104	R-309	1	1	1	5
x	x	R-310	RESISTOR: Fixed; comp.; 5600 ohms; ±10%; 2 w.; 0.405″ diam. x 1.78″ long; leads 1½″ long.	Bleeder, 250 V.	RC41BE562K	32	100-170-115	R-310 thru R-313	4	4	2	20
x	x	R-311	Same as R-310.	Bleeder, 250 V.								
x	x	R-312	Same as R-310.	Bleeder, 250 V.								

x	x	R-313	Same as R-310.	Bleeder, 250 V.								
x	x	R-314	RESISTOR: Fixed; comp.; 2200 ohms; ±10%; ½ w.; 0.249″ diam. x 0.655″ long; leads 1½″ long.	Plate resistor, V-302	RC21BF222K	30	100-202-115	R-314 R-320 R-325 R-330	4	4	2	20
	x	R-315	Same as R-113.	Primary loading, Z-303								
	x	R-316	RESISTOR: Fixed; comp.; 47,000 ohms; ±10%; ¼ w.; 0.170″ diam. x 0.406″ long; leads 1½″ long.	Secondary loading, Z-303	RC10BF473K	30	100-221-115	R-316 R-321 R-322 R-326 R-327 R-331	0	6	2	30
x		R-316	RESISTOR: Fixed; comp.; 470 ohms; ±10%; 1 w.; 0.31″ diam. x 1.28″ long; leads 1½″ long.	IF gain limiting resistor	RC31BF471K	30	100-300-115	R-316	1	0	1	5
x	x	R-317	RESISTOR: Variable; wire wound; 10,000 ohms; ±10%; 0.4 w.; body 1.78″ diam. x 0.98″ deep; shaft ⅞″ long including bushing ⅜″ long.	IF gain control	RA30A1RD103AK	33	100-218-115	R-317	1	1	1	5
x	x	R-318	Same as R-303.	Cathode resistor, V-303								
x	x	R-319	RESISTOR: Fixed; comp.; 27,000 ohms; ±10%; ½ w.; 0.249″ diam. x 0.655″ long; leads 1½″ long.	Screen resistor, V-303	RC21BF273K	30	100-226-115	R-319 R-324 R-329	3	3	2	15
x	x	R-320	Same as R-314.	Plate resistor, V-303								
	x	R-321	Same as R-316.	Primary loading, Z-304								
x		R-321	RESISTOR: Fixed; comp.; 47,000 ohms; ±10%; ¼ w.; 0.170″ diam. x 0.406″ long; leads 1½″ long.	Primary loading, Z-304	RC10BF473K	30	100-221-115	R-321 R-322 R-326 R-327 R-331	5	0	2	25
x		R-322	Same as R-321.	Secondary loading, Z-304								
	x	R-322	Same as R-316.	Secondary loading, Z-304								
x	x	R-323	Same as R-303.	Cathode resistor, V-304								
x	x	R-324	Same as R-319.	Screen resistor, V-304								
x	x	R-325	Same as R-314.	Plate resistor, V-304								

*Note: ±5% resistors—same as R-308, supplied as spares.

TABLE 8-3. COMBINED PARTS AND SPARE PARTS LIST (Continued)

PARTS											SPARE PARTS	
TS-635/UP	TS-318/UP	SYM. DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	JAN AND (NAVY TYPE) NO.	MFGR. AND MFGR'S. DESIGNATION	CONTRACTOR DRAWING & PART NO.	ALL SYM. DESIG. INVOLVED	TS-635/UP	TS-318/UP	EQUIP.	STOCK
	x	R-326	Same as R-316.	Primary loading, Z-305								
x		R-326	Same as R-321.	Primary loading, Z-305								
	x	R-327	Same as R-316.	Secondary loading, Z-305								
x		R-327	Same as R-321.	Secondary loading, Z-305								
x	x	R-328	Same as R-303.	Cathode resistor, V-305								
x	x	R-329	Same as R-319.	Screen resistor, V-305								
x	x	R-330	Same as R-314.	Plate resistor, V-305								
	x	R-331	Same as R-316.	Primary load ing, Z-306								
x		R-331	Same as R-321.	Primary loading, Z-306								
x	x	R-332	Same as R-215.	Grid resistor, V-306								
	x	R-333	Same as R-307.	Diode load resistor, V-306								
x		R-333	RESISTOR: Fixed; comp.; 22,000 ohms; ±10%; ½ w.; 0.249″ diam. x 0.655″ long; leads 1½″ long.	Diode load resistor, V-306	RC21BF223K	32	100-195-115	R-333	1	0	1	5
x		R-334	Same as R-111.	Plate resistor, V-306								
	x	R-334	Same as R-315.	Plate resistor, V-306								
x	x	R-335	RESISTOR: Fixed; comp.; 1.0 megohm; ±10%; ½ w.; 0.249″ diam. x 0.655″ long; leads 1½″ long.	"Video Output" shunt	RC21BF105K	30	100-199-115	R-335	1	1	1	5

	x	R-336	Same as R-315.	Limiting resistor, M-501									
x		R-336	Same as R-111.	Limiting resistor, M-501									
	x	R-337	Same as R-214.	#3 grid leak, V-302									
	x	R-401	Same as R-102.	Cathode resistor, V-401									
x		R-401	RESISTOR: Fixed; comp.; 820 ohms; ±5%; ½ w.; 0.249″ diam. x 0.655″ long; leads 1½″ long.	Cathode resistor, V-401	RC21BF821J	30	100-303-114	R-401	1	0	1	5
x		R-402	RESISTOR: Fixed; comp.; 39,000 ohms; ±10%; ½ w.; 0.249″ diam. x 0.655″ long; leads 1½″ long.	Voltage dropping, screen, V-401	RC21BF393K	30	100-257-115	R-402	1	0	△	△
	x	R-402	Same as R-315.	Screen resistor, V-401									
	x	R-403	RESISTOR: Fixed; comp.; 5.6 megohms; ±5%; ½ w.; 0.249″ diam. x 0.655″ long; leads 1½ long.	Suppressor resistor, V-401	RC21BF565J	30	100-230-114	R-403	0	1	1	5
x		R-403	RESISTOR: Fixed; comp.; 3.9 megohms; ±5%; ½ w.; 0.249″ diam. x 0.655″ long; leads 1½″ long.	Suppressor, V-401	RC21BF395J	30	100-339-114	R-403	1	0	1	5
x	x	R-404	RESISTOR: Fixed; comp.; 75,000 ohms; ±10%; ½ w.; 0.249″ diam. x 0.655″ long; leads 1½″ long.	Plate resistor, V-401	RC21BF753K	32	100-165-115	R-404	1	1	*	*
x	x	R-405	RESISTOR: Fixed; comp.; 24,000 ohms; ±10%; ½ w.; 0.249″ diam. x 0.655″ long; leads 1½″ long.	Cathode resistor, V-402	RC21BF243K	30	100-274-115	R-405 R-406 R-409	3	3	2	15
x		R-406	RESISTOR: Fixed; comp.; 33,000 ohms; ±5%; ½ w.; 0.249″ diam. x 0.655″ long; leads 1½ long.	Control grid leak, V-402	RC21BF333J	30	100-229-114	R-406 R-411	2	0	1	10
	x	R-406	Same as R-405.	Grid resistor, V-402									
x	x	R-407	RESISTOR: Fixed; comp.; 82,000 ohms; ±10%; 2 w.; 0.405″ diam. x 1.41″ long; leads 1½″ long.	"Zero Adj." bleeder	RC40BF823K	34	100-178-115	R-407	1	1	1	5
x	x	R-408	Same as R-303	CW plate resistor, V-402									
x	x	R-409	Same as R-405	Pulse plate resistor, V-402									
x	x	R-410	RESISTOR: Variable; comp.; 250,000 ohms; ±10%; 2 w.; linear tapers; body 1$\frac{1}{16}$″ diam. x $\frac{9}{16}$″ deep; shaft ⅝″ long including locking bushing ½″ long.	CW load resistor, V-403	(−635957-L10)	30	100-312-105	R-410	1	1	1	5

△Note: ±5% resistors—same as R-305 supplied as spares.

*Note: ±5% resistors—sames as R-105 supplied as spares.

TABLE 8-3. COMBINED PARTS AND SPARE PARTS LIST (Continued)

TS-635/UP	TS-318/UP	SYM. DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	JAN AND (NAVY TYPE) NO.	MFGR. AND MFGR'S. DESIGNATION	CONTRACTOR DRAWING & PART NO.	ALL SYM. DESIG. INVOLVED	TS-635/UP	TS-318/UP	SPARE PARTS EQUIP.	SPARE PARTS STOCK
	x	R-411	RESISTOR: Fixed; comp.; 33,000 ohms; ±5%; ½ w.; 0.249" diam. x 0.655" long; leads 1½" long.	Load resistor, V-403	RC21BF333J	30	100-229-114	R-411	0	1	1	5
x	x	R-412	RESISTOR: Fixed; comp.; 680,000 ohms; ±5%; w.; 0.249" diam. x 0.655" long; leads 1½" long.	Load resistor, V-403	RC21BF684J	30	100-276-114	R-412	1	1	1	5
x	x	R-413	RESISTOR: Variable; wire wound; 2500 ohms; ±10%; 2 w.; body 1.28" diam. x 0.62" deep; slotted shaft ½" long including bushing ⅜" long.	"FS adj." VTVM	RA20A25A252AK	33	100-223-115	R-413	1	1	1	5
x	x	R-414	RESISTOR: Fixed; comp.; 680 ohms; ±5%; ½ w.; 0.249" diam. x 0.655" long, leads 1½" long.	Bridge circuit	RC21BF681J	30	100-313-114	R-414	1	1	1	5
x	x	R-415	RESISTOR: Fixed; comp.; 3000 ohms; special; ½ w.; 0.249" diam. x 0.655" long; leads 1½" long.	Bridge circuit		14 100-254-114	100-254-114	R-415	1	1	1	5
	x	R-416	RESISTOR: Fixed; wire wound; 4000 ohms; ±1%; ¼ w.; 7/16" diam. x ¾" long; wire leads.	Bridge circuit	RB51B40000F	29	100-278-111	R-416 R-420	0	2	1	10
x	x	R-417	ATTENUATOR: Variable; "L" pad; comp.; constant input impedance 130 ohms; 2 w. per section; 1st section, 450 ohms; 2nd section, 120 ohms; 3 solder lugs per section; enclosed molded phenolic case with sealed cover; 1 1/16" diam. x 13/16" deep; shaft ¼" diam. x ⅞" long from mtg. face; insulated contact arms; logarithmic taper; bushing on 1st section, ⅜-32 x ⅜" long.	Attenuator	(−636846)	30	100-295-1	R-417	1	1	1	5
x	x	R-417A	RESISTOR: Variable; comp.; 120 ohms; part of R-417.	Shunt arm, "L" pad								
x	x	R-417B	RESISTOR: Variable; comp.; 450 ohms; part of R-417.	Series arm, "L" pad								
x	x	R-418	RESISTOR: Fixed; comp.; 39 ohms; ±5%; ½ w.; 0.249" diam. x 0.655" long; leads 1½" long.	Bridge circuit	RC21BF390J	30	100-314-114	R-418	1	1	1	5
x	x	R-419	RESISTOR: Fixed; wire wound; 65,000 ohms; ±1%; 11/16" diam. x 1 1/16" long; solder lug terminals; mounts with one #6-32 screw.	Bridge circuit	RB41B65001F	29	100-280-111	R-419	1	1	1	5

	x	R-420	Same as R-416.	Bridge circuit								
x		R-420	RESISTOR: Fixed; wire wound; 4500 ohms; ±1%; ¼ w.; 7/16" diam. x ¾" long; wire leads.	Bridge circuit	RB51B45000F	29	100-341-111	R-420	1	0	1	5
x	x	R-421	RESISTOR: Fixed; comp.; 20 ohms; ±5%; ½ w.; 0.249" diam. x 0.468" long; leads 1½" long.	Voltage divider	RC20BF200J	30	100-243-114	R-421 R-428 thru R-431	5	5	1	25
x	x	R-422	RESISTOR: Fixed; comp.; 160 ohms; ±5%; 1 w.; 0.280" diam. x 0.75" long; leads 1½" long.	Voltage divider	RC30BF161J	30	100-242-114	R-422	1	1	1	5
x	x	R-423	RESISTOR: Fixed; comp.; 170 ohms; ±5%; ½ w.; 0.249" diam. x 0.468" long; leads 1½" long.	Input series resistor, attenuator	RC20BF171J	30	100-327-104	R-423	1	1	*	5
x	x	R-424	RESISTOR: Fixed; comp.; 160 ohms; ±5%; ½ w.; 0.249" diam. x 0.468" long; leads 1½" long.	Series resistor attenuator	RC20BF161J	30	100-246-114	R-424 thru R-427	4	4	*	20
x	x	R-425	Same as R-424.	Series resistor attenuator								
x	x	R-426	Same as R-424.	Series resistor attenuator								
x	x	R-427	Same as R-424.	Series resistor attenuator								
x	x	R-428	Same as R-421.	Shunt resistor attenuator								
x	x	R-429	Same as R-421.	Shunt resistor attenuator								
x	x	R-430	Same as R-421.	Shunt resistor attenuator								
x	x	R-431	Same as R-421.	Shunt resistor attenuator								
x	x	R-432	RESISTOR: Fixed; comp.; 18 ohms; ±5%; ½ w.; 0.249" diam. x 0.468" long; leads 1½" long.	Shunt resistor attenuator	RC20BF180J	30	100-247-114	R-432	1	1	*	5
x	x	R-433	RESISTOR: Fixed; comp.; 56,000 ohms; ±10%; ½ w.; 0.249" diam. x 0.655" long; leads 1½" long.	R.F. filter, Sync.	RC21BF563K	31	100-214-115	R-433	1	1	1	5
x	x	R-434	RESISTOR: Fixed; comp.; 560 ohms; ±10%; 1 w.; 0.280" diam. x 0.75" long; leads 1½" long.	Current limiting resistors, V-404 and V-603	RC30BF561K	30	100-315-115	R-434 R-435	2	2	1	10
x	x	R-435	Same as R-434.	Current limiting resistors, V-404 and V-603								

*Note: R-423 thru R-432 (10 resistors) are supplied as a matched set in Equipment Spare Parts.

TABLE 8–3. COMBINED PARTS AND SPARE PARTS LIST (Continued)

PARTS											SPARE PARTS	
TS-635/UP	TS-318/UP	SYM. DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	JAN AND (NAVY TYPE) NO.	MFGR. AND MFGR'S. DESIGNATION	CONTRACTOR DRAWING & PART NO.	ALL SYM. DESIG. INVOLVED	TS-635/UP	TS-318/UP	EQUIP.	STOCK
x		R-436	RESISTOR: Fixed; comp.; 75 ohms; ±10%; ½ w.; 0.249″ diam. x 0.655″ long; leads 1½″ long.	Series grid resistor, V-402	RC21BF750K	30	100-342-115	R-436	1	0	1	5
	x	R-436	RESISTOR: Fixed; comp.; 220 ohms; ±10%; ½ w.; 0.249″ diam. x 0.655″ long; leads 1½″ long.	Series grid resistor, V-402	RC21BF221K	30	100-209-115	R-436	0	1	1	5
	x	R-437	Same as R-121	Bleeder, 250 V.								
x		R-438	RESISTOR: Fixed; comp.; 1.8 megohms; ±5%; ½ w.; 0.249″ diam. x 0.655″ long; leads 1½″ long.	Suppressor resistor, V-401	RC21BF185J	30	100-307-114	R-438	1	0	1	5
x		R-439	RESISTOR: Fixed; comp.; 910,000 ohms; ±5%; ½ w.; 0.249″ diam. x 0.655″ long; leads 1½″ long.	Suppressor resistor, V-401	RC21BF914J	30	100-340-114	R-439	1	0	1	5
x		R-440	RESISTOR: Fixed; comp.; 510,000 ohms; ±5%; ½ w.; 0.249″ diam. x 0.655″ long; leads 1½″ long.	Suppressor resistor, V-401	RC21BF514J	30	100-283-114	R-440	1	0	1	5
x	x	R-501	RESISTOR: Fixed; comp.; 300,000 ohms; ±5%; ½ w.; 0.249″ diam. x 0.655″ long; leads 1½″ long.	Multiplier 300 V., M-501	RC21BF304J	30	100-234-114	R-501	1	1	1	5
x	x	R-502	RESISTOR: Fixed; wire wound; 9950 ohms; ±1%; ¼ w.; $\frac{7}{16}$″ diam. x ¾″ long; wire leads.	Multiplier 110 V., M-501	RB51B99500F	29	100-316-111	R-502	1	1	1	5
x	x	R-503	RESISTOR: Variable; comp.; 50,000 ohms; ±10%; 2 w.; linear taper; body $1\frac{1}{16}$″ diam. x $\frac{9}{16}$″ deep; shaft ⅞″ long including bushing ⅜″ long.	Platevoltage control, V-402	(−631234-N10)	30	100-311-1	R-503	1	1	1	5
x	x	R-601	RESISTOR: Fixed; comp.; 100 ohms; ±10%; ½ w.; 0.249″ diam. x 0.655″ long; leads 1½″ long.	Hash filter	RC21BF101K	30	100-304-115	R-601 R-602	2	2	1	10
x	x	R-602	Same as R-601.	Hash filter								
x	x	R-603	RESISTOR: Fixed; comp.; 4.7 megohms; ±10%; 1 w.; 0.310″ diam. x 1.28″ long; leads 1½″ long.	Bleeder, 1000 V.	RC31BF475K	30	100-225-115	R-603 R-604	2	2	1	10
x	x	R-604	Same as R-603.	Bleeder, 1000 V.								

x	x	R-605	RESISTOR: Fixed; comp.; 180,000 ohms; ±10%; 1 w.; 0.310″ diam. x 1.28″ long; leads 1½″ long.	Bleeder, 250 V.	RC31BF184K	30	100-228-115	R-605	1	1	1	5
			SWITCHES									
x	x	S-101	SWITCH: Rotary; 2 pole, 3 position; single section; shorting type; cumulative counter-clockwise; silver alloy contacts and rotors; ceramic wafer; single hole mounting bushing ⅜-32; shaft 15/16″ long.	"Basic PRR"		8	120-021-101	S-101	1	1	0	0
			WAFER for S-101.				120-021-111		0	0	1	1
x	x	S-401	SWITCH: Rotary; 2 pole; 3 position; shorting type; no index; silver alloy contacts and rotor; ceramic wafer 1⅞″ x 1⅝″ x 7/32″ tk.; solder terminal; single hole mounting bushing ⅜-32; shaft 15/16″ long.	"CW-Pulse-OFF"		8	120-025-101	S-401	1	1	0	0
			WAFER for S-401.				120-025-111		0	0	1	1
x	x	S-402	SWITCH: Rotary; 1 pole, 3 position; shorting type; with index; silver alloy contacts and rotor; ceramic wafer 1⅞″ x 1⅝″ x 7/32″ tk.; solder terminal; single hole mounting bushing ⅜-32; shaft 13/16″ long.	Cathode resistor switch, V-403		8	120-030-101	S-402	1	1	0	0
			WAFER for S-402.				120-030-111		0	0	1	1
x		S-403	SWITCH: Rotary; 2 pole, 4 position; single section; non-shorting; with index; silver contacts and rotors; shaft slotted for screwdriver adjustment.	Variable pulse width, V-401		8 Type 53	12158-1	S-403	1	0	1	1
x	x	S-501	SWITCH: Rotary; 2 pole, 4 position; single section; 1st circuit, 4 contacts; 2nd circuit, 2 contacts; with index; silver alloy contacts and rotors; non-shorting; 2 dummy lugs; ceramic wafer; solder terminal; single hole mounting bushing ⅜-32; shaft 13/16″ long.	"Test-CW"		8 Type DHIC	120-026-101	S-501	1	1	0	0
			WAFER for S-501.				120-026-111		0	0	1	1
x	x	S-601	SWITCH: Rotary; Navy type packet; 110 VAC., 10 amp. inductive load contacts; consists of a 2 pole, 4 position section and a 5 pole, 4 position section separated by an aluminum shield 2¾″ diam. x 1/16″ tk.; both sections operate 1-2-3-OFF and are assembled to a common shaft ¼″ diam.; shaft length 2″; 4 mounting holes .154″ diam. on 1¼″ radius in the shield.	Power switch, "OFF-INT. BAT.-EXT. BAT.-115 VAC."	(−241319)	35	120-014-101	S-601	1	1	1	1

TABLE 8-3. COMBINED PARTS AND SPARE PARTS LIST (Continued)

PARTS											SPARE PARTS	
TS-635/UP	TS-318/UP	SYM. DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	JAN AND (NAVY TYPE) NO.	MFGR. AND MFGR'S. DESIGNATION	CONTRACTOR DRAWING & PART NO.	ALL SYM. DESIG. INVOLVED	TS-635/UP	TS-318/UP	EQUIP.	STOCK
					TRANSFORMERS							
	x	T-401	COIL, R.F.: Oscillator; 2 windings; iron core tuning; 1550 to 2500 kc.	Singal Generator, RF oscillator coil	(−472178)	14 3848-1	3848-1	T-401	0	1	1	3
x		T-401	COIL, R.F.: Oscillator; 2 windings; iron core tuning; 110 to 220 kc.	Signal Generator, RF oscillator coil	(−472286)	14 3940-1	3940-1	T-401	1	0	1	3
	x	T-501	TRANSFORMER, R.F.: primary and secondary single layer wound; primary 2 turns #24 e., secondary 50 turns #26 e.; iron core tuning.	Matching transformer, CU-142/U	(−472176)	14 21052-1	21052-1	T-501	0	1	0	0
x		T-501	TRANSFORMER, R.F.: two windings, single layer wound; primary 2 turns #30 e., secondary 75 turns #30 e.; iron core tuning.	Matching transformer, CU-155/U	(−472288)	14 21175-1	21175-1	T-501	1	0	0	0
x	x	T-601	TRANSFORMER: Power; plate type; primary #1—115 V., primary #2—6 V.; secondary #1—1.25 V. at 0.2 A.; secondary #2—500 VCT. at .08 A.; secondary #3—900 V. at .002 A.	Low and high plate voltage	(−303950)	25	125-032-1	T-601	1	1	1	3
x	x	T-602	TRANSFORMER: Power; filament type; primary 115 V.; secondary 6.3 V. at 3.5 A.	Filament voltage	(−303951)	25	125-031-1	T-602	1	1	1	3
					TUBES, ELECTRON							
x	x	V-101	TUBE: Electron; type 6AS6.	200 cycle osc.	6AS6	36	130-030-101	V-101 V-102 V-401	3	3	3	0
x	x	V-102	Same as V-101.	Sweep oscillator								
x	x	V-103	TUBE: Electron; type 9002	Sweep oscillator	9002	37	130-031-101	V-103 V-104	2	2	2	0
x	x	V-104	Same as V-103.	Sweep amplifier								
x	x	V-201	TUBE: Electron; cathode ray; type 2AP1A.	Cathode ray indicator	2AP1A	37	130-029-101	V-201	1	1	1	0
x	x	V-301	TUBE: Electron; type 6AK5	RF amplifier	6AK5	36	130-041-101	V-301 V-402	2	2	2	0

x	x	V-302	TUBE: Electron; type 6SA7	Oscillator-mixer	6SA7	38	130-032-101	V-302	1	1	2	0
x	x	V-303	TUBE: Electron; type 9003.	1st IF amplifier	9003	37	130-034-101	V-303 V-304 V-305	3	3	3	0
x	x	V-304	Same as V-303.	2nd IF amplifier								
x	x	V-305	Same as V-303.	3rd IF amplifier								
x	x	V-306	TUBE: Electron; type 6AQ6.	Detector - video amplifier	6AQ6	37	130-033-101	V-306	1	1	2	0
x	x	V-401	Same as V-101.	Pulse generator								
x	x	V-402	Same as V-301.	RF oscillator								
x	x	V-403	TUBE: Electron; type 6AL5	VTVM rectifier	6AL5	39	130-040-101	V-403	1	1	2	0
x	x	V-404	TUBE: Electron; type OA3/VR-75	Voltage regulator	OA3/VR-75	37	130-020-101	V-404	1	1	2	0
x	x	V-601	TUBE: Electron; type 8016.	HV rectifier	8016	37	130-036-101	V-601	1	1	2	0
x	x	V-602	TUBE: Electron; type 6X5GT/G	LV rectifier	6X5GT/G	40	130-035-101	V-602	1	1	2	0
x	x	V-603	TUBE: Electron; type OD3/VR-150.	Voltage regulator	OD3/VR-150	37	130-037-101	V-603	1	1	2	0
				CABLE ASSEMBLIES								
x	x	W-501	Not used.									
x	x	W-502	Not used.									
x	x	W-503	CABLE ASSEMBLY: Single conductor, stranded 25-#34 tinned copper wire; consists of soft rubber core, tinned copper braid, cotton braid, .031″ rubber outer covering, round, .0245″ O.D.; 5′6″ ±3″ long excluding terminations; P-503 on one end; other end unterminated.	External sync. cable		14 11922-1	11922-1	W-503 W-504	2	2	2	4
x	x	W-504	Same as W-503; P-504 on one end; other end unterminated.	Video output cable								
x	x	W-505	CABLE ASSEMBLY: Power; 6 conductors, stranded 2-#12 AWG, 2-#16 AWG, 2-#20 AWG, each conductor insulated with .016″ polyvinyl chloride; consists of insulated conductor, cotton cord filler, varnished cambric, tinned copper braid covered by .031″ Buna S rubber, round 15/32″ O.D.; P-604 and H-612 on one end, P-605 and H-613 on other end.	Interunit power cable	(−62407(6′6″))	14 20978-1	20978-1	W-505	1	1	1	2

TABLE 8-3. COMBINED PARTS AND SPARE PARTS LIST (Continued)

PARTS											SPARE PARTS	
TS-635/UP	TS-318/UP	SYM. DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	JAN AND (NAVY TYPE) NO.	MFGR. AND MFGR'S. DESIGNATION	CONTRACTOR DRAWING & PART NO.	ALL SYM. DESIG. INVOLVED	TS-635/UP	TS-318/UP	EQUIP.	STOCK
x	x	W-506	CABLE ASSEMBLY: Battery; single conductor; stranded 62 - #30 tinned copper, #12 AWG; synthetic resin insulation, white; .157″ overall dia.; JAN SRIR-6(65); Burndy Type YAV-10-H3 terminal one end; E-606 and E-608 on other end; 4′±1″ excluding terminations.	"Positive" cable for external battery		14 20976-2	20976-2	W-506	1	1	0	0
x	x	W-507	CABLE ASSEMBLY: Battery; single conductor; stranded 62 - #30 tinned copper, #12 AWG, synthetic resin insulation, black; .157″ overall dia.; JAN SRIR-6(65); Burndy Type YAV-10-H3 terminal one end; E-607 and E-609 on other end; 4′±1″ excluding terminations.	"Negative" cable for external battery		14 20976-1	20976-1	W-507	1	1	0	0
x	x	W-508	CABLE ASSEMBLY: Power; two conductor; #16 AWG stranded bare copper; rubber insulation; 3/8″ overall dia.; U. S. Rubber Co. Type DCOP3; includes P-602 on one end and P-603 on the other end; 8′±1″ long.	115 VAC cable		14 20968-1	20968-1	W-508	1	1	0	0
SOCKETS												
x	x	X-101 X-102 X-103 X-104 X-301 X-303 X-304 X-305 X-306 X-401 X-402 X-403	SOCKET: Tube; miniature; ceramic.		S010C	16	135-013-103	X-101 X-102 X-103 X-104 X-301 X-303 X-304 X-305 X-306 X-401 X-402 X-403	12	12	1	12
x	x	X-201	SOCKET: Tube; magnal; low loss insulation.	Socket for V-201	(−49708)	41 9452W1	135-015-101	X-201	1	1	1	1

x	x	X-302 X-303 X-404 X-602 X-603 X-604	SOCKET: Tube; octal; low loss; molded.		(–491071)	41 9703FV	135-014-101	X-302 X-303 X-404 X-602 X-603 X-604	6	6	1	5
x	x	X-601	SOCKET: 4 contact; mica-filled phenolic.	Socket for Y-601, vibrator	(–49390-A)	21 M1P4TM	135-016-101	X-601	1	1	1	1
			VIBRATORS									
x	x	Y-601	VIBRATOR: Non-synchronous; 6 V; 8 contact; hermetically sealed; base connection A-2.		(–20623)	42 634C	70-028-101	Y-601	1	1	1	5
			COMPOUND ASSEMBLIES									
	x	Z-301	COIL, R.F.: Shielded; 13/16″ square x 3 1/8″ high overall; two windings; secondary inductance adjusted by powdered iron core for tuning from 1550 to 2500 kc.; screwdriver adj. on top of can; mtg. - two inserts #2-56 thread, 17/32″ mtg. centers; 4 glass bonded solder lug terminals; gasket sealed adj. cover.	Receiver R.F. transformer	(–472173)	10 13900	125-028-101	Z-301	0	1	1	3
x		Z-301	COIL, R.F.: Shielded; 13/16″ square x 3 1/8″ high overall; two windings; secondary inductance adjusted by powdered iron core for tuning from 110 to 220 kc.; screwdriver adj. on top of can; mtg. - two inserts #2-56 thread, 17/32″ mtg. centers; 4 glass bonded solder lug terminals; gasket sealed adj. cover.	Receiver R.F. transformer	(–472287)	14 21146-1	21146-1	Z-301	1	0	1	3
	x	Z-302	COIL, R.F.: Shielded; single winding; series fixed capacitor internally connected to terminal #1; 1 3/16″ square x 3 1/8″ high overall; phenolic form; powdered iron core tuning; screwdriver adj. through top of can; mtg. - two inserts #2-56 thread, 17/32″ mtg. centers; 4 glass bonded solder lug terminals; gasket sealed adj. cover.	Receiver oscillator coil	(–472174)	10 13903	125-029-101	Z-302	0	1	1	3
x		Z-302	COIL, R.F.: Shielded; 3pi sections connected in series, sec #1 - 160T, sec #2 and #3 - 130T; fired capacitor internally connected to term. #1 and #4; 1 3/16″ square x 3 1/8″ high overall; phenolic form; powdered iron core tuning; mtg. - two inserts #2 - 56 thread, 17/32″ mtg. centers 4 glass bonded solder lug terminals; gasket sealed adj. cover.	Receiver oscillator coil		14 21147-1	21147-1	Z-302	1	0	1	3

TABLE 8-3. COMBINED PARTS AND SPARE PARTS LIST (Continued)

PARTS											SPARE PARTS	
TS-635/UP	TS-318/UP	SYM. DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	JAN AND (NAVY TYPE) NO.	MFGR. AND MFGR'S. DESIGNATION	CONTRACTOR DRAWING & PART NO.	ALL SYM. DESIG. INVOLVED	TS-635/UP	TS-318/UP	EQUIP.	STOCK
x	x	Z-303	TRANSFORMER, I.F.: 455 kc.; shielded; powdered iron cores; double tuned; mtg. - two #6-32 spade bolts ⅞" c to c; 4 glass bonded solder lug terminals; gasket sealed removable tuning adj.; cap on each end; 1¼" square x 4⅜" high overall.	Input IF transformer	(−472169)	18 SA-4335	125-035-1	Z-303 thru Z-306	4	4	1	12
x	x	Z-304	Same as Z-303.	1st IF interstage								
x	x	Z-305	Same as Z-303.	2nd IF interstage								
x	x	Z-306	Same as Z-303.	Output IF transformer								
x		Z-307	TRANSFORMER, R.F.: Antenna.	Receiver antenna coupling	(−472289)	14 21141-1	21141-1	Z-307	1	1	1	3
			BATTERIES									
x	x	BT-601	BATTERY: Storage; 6 V.	Internal power supply	Navy class 6V-SBM-50AH	43	70-029-1	BT-601	1	1	0	0
			RECTIFIERS, CRYSTAL									
x	x	CR-101	CRYSTAL UNIT: Rectifier	Rectifier, V-101	JAN IN34	40 IN34	70-040-1	CR-101	1	1	10	0
x			ASSEMBLY, Antenna		AS-400/UP	14 4265-36 3827-1	4265-36 3827-1		1	0	0	2
	x		ASSEMBLY, Antenna		AS-377/U	14 4265-1 3827-1	4265-1 3827-1		0	1	0	2
x	x		ADAPTER, generator output		(−62408)	14 21059-1	21059-1		1	1	1	2
	x		ANTENNA COUPLER		CU-142/U	14 3872-1	3872-1		0	1	1	3
x			ANTENNA COUPLER		CU-155/U	14 3872-30	3872-30		1	0	1	3

TABLE 8–4. CROSS REFERENCE PARTS LIST

JAN (OR AWS) DESIGNATION	TS–635/UP	TS–318/UP	KEY SYMBOL	JAN (OR AWS) DESIGNATION	TS–635/UP	TS–318/UP	KEY SYMBOL	JAN (OR AWS) DESIGNATION	TS–635/UP	TS–318/UP	KEY SYMBOL
CM20B151K	x	x	C-117*	MR35W001DCMA	x	x	M-501	RC21BF684J	x	x	R-412
CM20B271K	x	x	C-117*	MR35W200DCUA	x	x	M-502	RC21BF681J	x	x	R-414
CM20B391K	x	x	C-117*	RA20A25A252AK	x	x	R-413	RC21BF390J	x	x	R-418
CM20B101K	x	x	C-206	RA30A1RD103AK	x	x	R-317	RC21BF563K	x	x	R-433
CM20B271J	x		C-404	RA30A1RD153AK	x	x	R-107	RC21BF750K	x		R-436
CM20B240J		x	C-404	RB13B30002F	x	x	R-109	RC21BF221K		x	R-436
CM20B471M	x	x	C-410	RB41B65001F	x	x	R-419	RC21BF185J	x		R-438
CM20C390K		x	C-301	RB51B40000F		x	R-416	RC21BF914J	x		R-439
CM20C101J	x		C-306	RB51B45000F	x		R-420	RC21BF514J	x		R-440
CM20C470K		x	C-306	RB51B99500F	x	x	R-502	RC21BF304J	x	x	R-501
CM20C471J		x	C-401	RC10BF473K		x	R-316	RC21BF101K	x	x	R-601
CM20C390J	x		C-416	RC10BF473K	x		R-321	RC30BF161J	x	x	R-422
CM25B821J	x		C-401	RC20BF161J	x	x	R-424	RC30BF561K	x	x	R-434
CM30B162J	x		C-418	RC20BF171J	x	x	R-423	RC31BF104K	x	x	R-304
CM30B332J	x		C-419	RC20BF180J	x	x	R-432	RC31BF471K	x		R-316
CM30B102J		x	C-501	RC20BF200J	x	x	R-421	RC31BF475K	x	x	R-603
CM30E242G	x	x	C-103	RC21BF475K	x	x	R-101	RC31BF184K	x	x	R-605
CM30E302G	x	x	C-110	RC21BF152J	x	x	R-102	RC40BE472J	x	x	R-309
CM30E102G	x	x	C-111	RC21BF513J	x	x	R-103	RC40BF823K	x	x	R-407
CM35B103K	x	x	C-105	RC21BF392J	x	x	R-104	RC41BE562K	x	x	R-310
CM35B103M	x	x	C-402	RC21BF753J	x	x	R-105	S0S3	x	x	H-104
CM35B512J	x		C-420	RC21BF104K	x	x	R-111	S0S6	x	x	H-305
CM50B472M	x	x	C-204	RC21BF202J	x	x	R-112	S010C	x	x	X-101
CP29A1EH503X	x	x	C-201	RC21BF134J	x	x	R-113				
CP29A2EE104X		x	C-417	RC21BF224K	x	x	R-116				
CP29A1EH602K	x	x	C-604	RC21BF185K	x	x	R-117				
CP41B1EH504X	x	x	C-606	RC21BF752K	x	x	R-118				
CP51B1EE504X	x	x	C-403	RC21BF473K	x	x	R-120				
CP53B4EF104L	x	x	C-601	RC21BF474K	x	x	R-121				
CP54B1FF104X	x	x	C-608	RC21BF272J	x	x	R-122				
CP61B1EF503K	x	x	C-101	RC21BF475J	x	x	R-204				
CP61B1EE254K	x	x	C-102	RC21BF104J	x	x	R-212				
CP61B1EE105X	x	x	C-113	RC21BF334K	x	x	R-214				
CP67B5EE503X	x	x	C-307	RC21BF103K	x	x	R-215				
CP67B1EE104X	x	x	C-311	RC21BF471K	x	x	R-303				
CP69B5EE503X	x	x	C-304	RC21BF393J	x	x	R-305				
CP69B1FF504V	x	x	C-602	RC21BF472K		x	R-306				
CP70B1DF106X	x	x	C-605	RC21BF223K		x	R-307				
CV12D121	x	x	C-115	RC21BF183K	x		R-307				
JAN-1N34	x	x	CR-101	RC21BF183J	x	x	R-308				
JAN-2AP1A	x	x	V-201	RC21BF222K	x	x	R-314				
JAN-6AK5	x	x	V-301	RC21BF273K	x	x	R-319				
JAN-6AL5	x	x	V-403	RC21BF223K	x		R-333				
JAN-6AQ6	x	x	V-306	RC21BF105K	x	x	R-335				
JAN-6AS6	x	x	V-101	RC21BF821J	x		R-401				
JAN-6SA7	x	x	V-302	RC21BF393K	x		R-402				
JAN-6X5-GT/G	x	x	V-602	RC21BF565J		x	R-403				
JAN-8016	x	x	V-601	RC21BF395J	x		R-403				
JAN-9002	x	x	V-103	RC21BF753K	x	x	R-404				
JAN-9003	x	x	V-303	RC21BF243K	x	x	R-405				
JAN-OA3/VR-75	x	x	V-404	RC21BF333J	x		R-406				
JAN-OD3/VR-150	x	x	V-603	RC21BF333J		x	R-411				

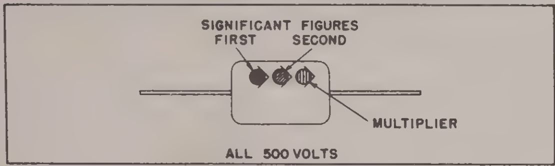
* Note: C-117—Only one alternate item used per unit. Value determined in production.

TABLE 8–4. CROSS REFERENCE PARTS LIST

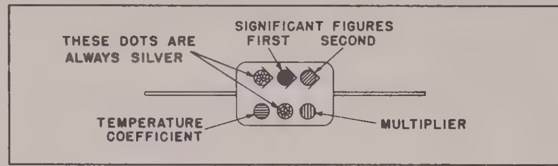
NAVY TYPE	TS-635/UP	TS-318/UP	KEY SYMBOL
20623	x	x	Y-601
241319	x	x	S-601
28030-10	x	x	F-601
28032-1	x	x	F-603
303950	x	x	T-601
303951	x	x	T-602
303952	x	x	L-604
471474	x	x	L-605
472169	x	x	Z-303
472170	x	x	L-603
472171	x	x	L-601
472172	x	x	L-405
472173		x	Z-301
472174	x	x	Z-302
472175	x	x	L-401
472177		x	L-501
472178		x	T-401
483202		x	C-302
484740		x	C-405
484741		x	C-305
484742		x	C-303
49025-A	x	x	J-502
49390-A	x	x	X-601
49496	x	x	H-404
49708	x	x	X-201
49825	x	x	P-602
491071	x	x	X-302
491077	x	x	P-603
491108	x	x	J-601
491821	x	x	J-503
491822	x	x	H-610
491823	x	x	H-609
62407 (6′6″)	x	x	W-505
626826-N10	x	x	R-216
631234-N10	x	x	R-503
635957	x	x	R-410
636723-M10	x	x	R-115
636827-R10	x	x	R-202
636846	x	x	R-417
ARMY-NAVY TYPE			
AN-3102-22-24P	x	x	J-501
AN-3102-22-24S	x	x	J-602

CAPACITOR COLOR CODES

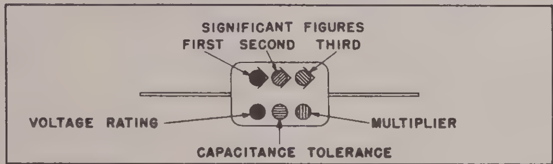
RMA 3-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



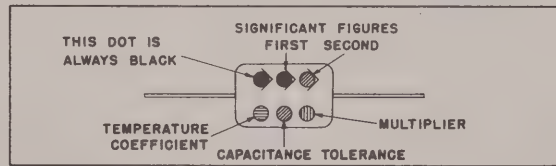
JAN 6-DOT COLOR CODE FOR PAPER – DIELECTRIC CAPACITORS



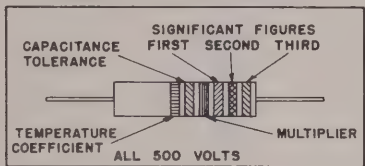
RMA 6-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



JAN 6-DOT COLOR CODE FOR MICA - DIELECTRIC CAPACITORS

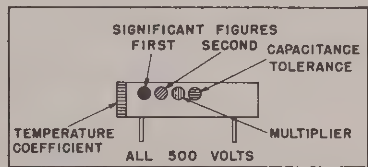


RMA COLOR CODE FOR TUBULAR
CERAMIC - DIELECTRIC CAPACITORS

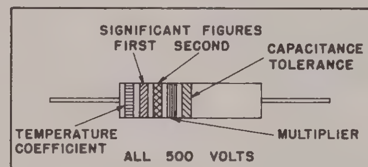


JAN COLOR CODE FOR FIXED CERAMIC-DIELECTRIC CAPACITORS

RADIAL TYPE NON - INSULATED



AXIAL TYPE INSULATED



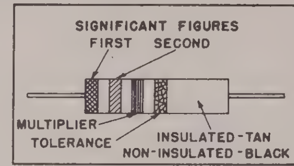
RMA : RADIO MANUFACTURES ASSOCIATION
JAN : JOINT ARMY - NAVY

RESISTORS		CAPACITORS						
TOLERANCE	MULTIPLIER	SIGNIFICANT FIGURE	COLOR	MULTIPLIER: RMA MICA AND CERAMIC-DIELECTRIC	MULTIPLIER: JAN MICA AND PAPER-DIELECTRIC	MULTIPLIER: JAN CERAMIC DIELECTRIC	VOLTAGE RATING	TEMPERATURE COEFFICIENT
	1	0	BLACK	1	1	1		A
	10	1	BROWN	10	10	10	100	B
	100	2	RED	100	100	100	200	C
	1,000	3	ORANGE	1,000	1000	1000	300	D
	10,000	4	YELLOW	10,000			400	E
	100,000	5	GREEN	100,000			500	F
	1,000,000	6	BLUE	1,000,000			600	G
	10,000,000	7	VIOLET	10,000,000			700	
	100,000,000	8	GRAY	100,000,000		0.01	800	
	1,000,000,000	9	WHITE	1,000,000,000		0.1	900	
5	0.1		GOLD	0.1	0.1		1000	
10	0.01		SILVER	0.01	0.01		2000	
20			NO COLOR				500	

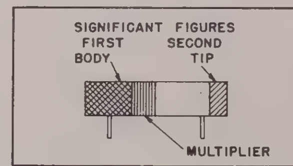
RESISTOR COLOR CODES

RMA COLOR CODE FOR
FIXED COMPOSITION RESISTORS

AXIAL TYPE

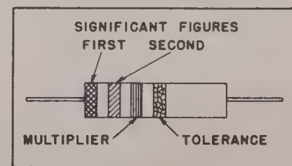


RADIAL TYPE



JAN COLOR CODE FOR
FIXED COMPOSITION RESISTORS

AXIAL TYPE INSULATED



RADIAL TYPE NON-INSULATED

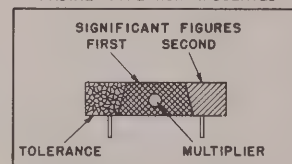


TABLE 8–6. LIST OF MANUFACTURERS

MFGR. NO.	PREFIX	NAME	ADDRESS
1	CAW	Aerovox Corporation	New Bedford, Mass.
2	CMF	Electro Motive Mfg. Co.	Willimantic, Conn.
3	CD	Cornell Dublier Corporation	South Plainfield, N. J.
4	CBN	Centralab Mfg. Co.	Milwaukee, Wis.
5	CSF	Sprague Electric Co.	North Adams, Mass.
6	CHC	Hammarlund Mfg. Co.	New York, N. Y.
7	CRK	Radio Condenser Co.	Camden, N. J.
8	COC	Oak Mfg. Co.	Chicago, Ill.
9	CSL	Solar Mfg. Corp.	Bayonne, N. J.
10	CFW	F. W. Sickles Co.	Chicopee, Mass.
11	CBV	J. E. Fast & Co.	Chicago, Ill.
12	CAN	Sangamo Electric Co.	Springfield, Ill.
13	CGF	Gudeman Co.	Chicago, Ill.
14	CWI	Washington Institute of Technology, Inc.	Washington, D. C.
15		Harry Davies Molding Co.	Chicago, Ill.
16	CEB	Eby Specialty Sales Co.	New York, N. Y.
17	CLF	Littelfuse, Inc.	Chicago, Ill.
18	CNA	National Co., Inc.	Malden, Mass.
19	CAIS	Birtcher Corp.	Los Angeles, Cal.
20	CAYT	Allen Mfg. Co.	Hartford, Conn.
21	CPH	American Phenolic Corp.	Chicago, Ill.
22	CBIN	Carter Radio Div., Precision Parts Co.	Chicago, Ill.
23	CHU	Harvey Hubbell, Inc.	Bridgeport, Conn.
24	CJA	James Millen Mfg. Co., Inc.	Malden, Mass.
25	CUT	United Transformer Corp.	New York, N. Y.
26	CV	Weston Electrical Instrument Corp.	Newark, N. J.
27	CAHW	Croname, Inc.	Chicago, Ill.

TABLE 8–6. (Cont'd) LIST OF MANUFACTURERS

MFGR. NO.	PREFIX	NAME	ADDRESS
28	CEJ	E. F. Johnson Co.	Waseca, Minn.
29	CSM	Shallcross Mfg. Co.	Collingdale, Pa.
30	CBZ	Allen Bradley Co.	Milwaukee, Wis.
31	CSA	Stackpole Carbon Co.	St. Marys, Pa.
32	CIR	International Resistance Co.	Philadelphia, Pa.
33	CTC	Chicago Telephone Supply Co.	Elkhart, Ind.
34	CER	Erie Resistor Corp.	Erie, Pa.
35	CAYC	Ark-Les Switch Corp.	Watertown, Mass.
36	CNU	National Union Radio Corp.	Orange, N. J.
37	CRC	R.C.A. Mfg. Co.	Harrison, N. J.
38	CKR	Ken-Rad Div., General Electric Co.	Owensboro, Ky.
39	CHY	Hytron Radio Electronics Corp.	Salem, Mass.
40	CHS	Sylvania Electric Products, Inc.	Emporium, Pa.
41	CMG	Cinch Mfg. Corp.	Chicago, Ill.
42	CMA	P. R. Mallory & Co., Inc.	Indianapolis, Ind.
43	CES	Electric Storage Battery Co.	Philadelphia, Pa.
44		Mueller Electric	Cleveland, Ohio

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